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OF

NORTH AMERICAN INSECTS.

By **B. JAEGER,**

LATE PROFESSOR OF ZOOLOGY AND BOTANY IN THE COLLEGE OF NEW JERSEY.

ASSISTED BY H. C. PRESTON, M.D.

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FROM SPECIMENS IN THE CABINET OF THE AUTHOR.

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P R E F A C E.

PHILOSOPHY has invested even the commonest objects of Nature with charms unknown to the uneducated. The conditions of our being are such, that we are tied by destiny to every object; and the more intimate and appreciable the connection, the more interesting and important to us becomes a full understanding of our mutual relations and dependencies in the vast arena of Life. No part of Natural Science, therefore, can be considered unimportant or devoid of interest. Still there are differences in our appreciation of its individual parts, as there are differences in our tastes and mental capacities. If we are accustomed, like the sportive birds in their splendid plumage and graceful motions, to look down upon the mammalia as the real laboring class in the dominion of the Animal Kingdom; if we despise the Reptiles on account of their ugliness and the deadly venom which they contain, still we may approach with pleasure the class of Fishes, the greatest part of which are excellent food, a valuable article of commerce, and a great source of wealth to many nations.

No branch of Natural History deserves a more careful and thorough study than the class of Insects, because none is more abounding in use or injury to man.

The study and knowledge of the companions that swarm around us on every tree and flower, in the air about us, and on the earth beneath us, must be important and interesting to every one, of whatever mental capacity or taste. And it has been very generally so considered, for the rich and poor, lettered and unlettered, the statesman and philosopher, manufacturer and merchant, husbandman and horticulturist, clergyman and physician, have often made this study the principal occupation of their leisure hours.

There is no class of animals with which so many persons have been occupied, and on which so many valuable and splendid works have been published, as on Insects, particularly Beetles and Butterflies. None of Earth's creatures have attracted more universal admiration than these. Many to whom the Book of Nature is a sealed book have been enticed, by the splendor of their color and their fairy-like motions, to hunt for them in meadows, fields, and woods, to place them as ornaments in rich frame-work upon the walls of their parlors, or to nourish and raise them with the greatest care in their rooms, that they may not lose a single hair of their magnificent, variegated dress.

No class of animals presents so great diversity of occupation and so many grades of society as the Insects. Here we see the industrious laborer busy at his work, there the lazy lounging beggar; here upon the leafy boughs, or before the gates of their subterranean abodes, myriads of musicians are playing their fiddles, and there the skillful artist is building his wonderful dwelling; while above in the blue sky flutters a high nobility, clad in gold, silver, purple, and silk, fed on the nectar of flowers; and on the earth below

are lurking troublesome drones and disgusting parasites.

Now, although we have a great number of learned men in our country who have distinguished themselves in the different branches of Natural History, still few works have been published on the subject. Much credit is due to Professor Godman for his excellent work on *American Mammalia*, which has been augmented by the late publications of Audubon; also to Wilson, Lucien Bonaparte, and Audubon, who, in their splendid works, have minutely described the North American Birds; as well as to Professor Holbrook for his work on North American Reptiles. Still, in spite of all this, we have no general work on North American Insects, except a few numbers of the *American Entomology*, by Thomas Say; Major Leconte's *Iconography* of some genera of Butterflies; and Dr. Harris's elaborate report on the injurious Insects of Massachusetts.

It is time that our people in general, and particularly our youth, should be made acquainted with a class of animals which every where surround us, day and night, and which furnish us amusement, food, coloring substances, and medicines, in order that they may be able to distinguish the useful from the injurious ones, the harmless from the noxious, and to discover those which may furnish new articles for manufactures, commerce, and domestic industry.

For these reasons I have yielded to the solicitations of numerous friends, and am about to lay before the North American public the fruits of my Entomological investigations, pursued for many years during my extensive travels in Europe, Asia, and on this Conti-

nent, and accompanied by a thorough examination of all the works published on this subject in the various European languages.

To accomplish this, I am aware, will be attended with no little difficulty; for, as in the *Mammalia* and *Birds*, so also among *Insects*, we have diurnal and nocturnal ones. Thus the *Diamond Beetle* shows its gold, ruby, emerald, and hyacinth colors in the clear and bright sunlight, and the same is the case with many *Butterflies*, who are on that account called diurnal; while the *Hawk Moths*, with a suspicious modesty, issue from their dwellings, adorned with bridal dresses, only at twilight; and only toward midnight are seen the gigantic *Cecropia*, and many others, in their variegated cloaks, or the unicolored, unpretending *Luna*; and these *Insects* are hence called nocturnal. In order to perfect the task, I have rambled many sunny days and many tropical nights, guided by the dim and twinkling lamps of heaven, through open fields, dark woods, and damp meadows, stimulated by the satisfactory assurance that these labors can not fail of being useful to all students of Nature, and encouraged by the hope that thus a way may be opened to a more general knowledge of Natural History, and a deeper admiration of the ten thousand sublime and beautiful creatures that, in one common song of praise, pour out their gratitude and proclaim their dependence upon one common Father.

NORTH AMERICAN INSECTS.

CLASSIFICATION OF INSECTS.

THE science which treats of Insects is called *Entomology*. It shows us the division of Insects into different Orders, Families, Genera, and Species. It makes us acquainted with their external characteristics and their nature, their injuries and their uses.

The name Insect is given to those small animals which are *invertebrated*, that is, whose bodies are not supported by a bony frame, but are composed of many rings or *intersections* jointed together. Hence the name Insect. Each of these has at least six legs, when in a perfect condition.

Although Insects differ from the *vertebrate* animals, viz., from Beasts, Birds, Reptiles, and Fishes, which are provided with a bony frame and red blood, still they are entirely analogous to them in regard to many of their physical functions, in nervous *Sensation* and *Perception*, in regard to *Respiration*, which is effected by respiratory organs, or air-holes placed on the hind-body, and in regard to *Nutrition*, which is effected through a stomach and intestines.

Insects are found in the air, as, for instance, Butterflies; or in the water, as the whirling Water-beetle; or in the ground, as the Sand-flea; or on plants, as the Caterpillars; or upon the body of animals, as Ticks and other Spongers.

There is scarcely a plant or an animal which is not the dwelling of some Insect. Hence the number of Insects must be immense, and without exaggeration it may be said that there are in existence more than a hundred thousand

different species. If we adopt the general rule, that on an average three species of Insects dwell on each species of plants (and on some plants we find three or four times as many), we can easily see that such an enormous number can not prove too small an estimate, when we consider that there are now known between forty and fifty thousand species of plants.

The nourishment of Insects is as varied and different as that of larger animals. A great number of them are carnivorous, and prey upon other insects; or they feed on dirt, dead bodies, or decayed wood, as the dung-beetles, flies, ants, and the larvæ of the stag-beetle; or they feed on plants, as the May-beetle, plant-lice, etc.

In regard to the *venom* of Insects, we find a number of them provided with organs for biting or stinging, which occasion inflammatory tumors and poisoned wounds, which are oftentimes dangerous, and sometimes fatal to man, as, for instance, the sting of bees, wasps, and mosquitoes.

The faculty called *Instinct*, which belongs to all animals, and by which, from an internal impulse, and without instruction, they perform certain actions tending to their own support or that of their offspring, is also found in Insects, as well as some faculties of the mind which would astonish an observer. Thus, when the Tumble-beetle in vain tries to roll its little ball up a hill, it runs for assistance, and brings back with it two or three other ones who roll up the ball in concert with it, but as soon as they have succeeded, the assistants fly away, and the first one continues his work alone. Bees, Wasps, and Ants defend themselves with great courage, and woe to him who attacks a wasp's nest! Some flower-beetles, like opossums, pretend to be dead when you catch them, or at your approach conceal themselves behind a leaf, or fall to the ground as if dead. Some have even memory, and know perfectly well the one who takes care of them, as, for instance, the Bees. The nests and dwell-

ings of many Insects often surpass those of birds in the skill displayed in their construction, etc., as the vespiaries, or artificial dwellings of Wasps, or the tents of the Tent-caterpillar, or the variously constructed cocoons of Butterflies. But we can not enlarge more upon these qualities, as they will be mentioned in the descriptions of the different Insects.

According to the improved, ingenious arrangement of Linnæus, Insects are divided into the following seven orders, viz. :

- I. *Coleoptera*. BEETLES or CHAFERS.—All Insects with horny bodies, six legs, and four wings, of which the upper ones are horny, and the lower ones parchment-like, as the Stag-beetle, May-beetle, etc.
- II. *Hemiptera*. BUGS.—All Insects with four parchment-like wings, six legs, and who obtain their nourishment by sucking with a movable proboscis, as the Cicadas, Plant-lice, Bed-bugs, etc.
- III. *Orthoptera*. STRAIGHT-WINGED INSECTS.—Insects with four parchment-like wings, of which the upper ones overlap on the back, and the two under ones are thin and folded together like a fan. They differ from those of the preceding order in that they have strong jaws instead of a movable proboscis, as, e. g., the Grasshopper, Cricket, and many others.
- IV. *Lepidoptera*. BUTTERFLIES, HAWK-MOTHS, and MOTHS.—Insects with four expanded wings, covered with colored farinaceous scales.
- V. *Neuroptera*. NET-WINGED INSECTS.—Those which have four transparent, net-woven, or lattice-like wings, as the Dragon-fly, etc.
- VI. *Hymenoptera*. VEIN-WINGED INSECTS.—With four transparent, veined wings, and generally provided with a venomous sting, as Bees, Wasps, etc.
- VII. *Diptera*. TWO-WINGED INSECTS.—As Flies and Mosquitoes.

ORDER I.

BEETLES—(*COLEOPTERA*).

Figure 1.



Repandous Tiger Beetle.

Figure 2.



Six-spotted Tiger Beetle.

Of the class of Insects the Beetles (*Coleoptera*) occupy, without doubt, the highest rank, as far as regards their external construction. Their whole body is covered with a horny skin, and divided into a head, chest (*thorax*), and hind-body (*abdomen*). Their organs of mastication are two nippers or jaws, with an upper and an under lip. The "feelers" (*antennæ*) are probably the organs of hearing. The under wings, which are like parchment, are so completely covered by two horny upper wings that they seem to form one solid mass with the body, which is not the case with any other order of Insects. In other animals of this class the wings from their position, form, and substance, are so different from their bodies, that they seem more like accidental appendages.

Beetles are all oviparous, and undergo a perfect transformation, or metamorphosis. From the egg proceeds a soft-bodied grub or maggot; for instance, the larva of the May-beetle, provided with six legs, and the larvæ of the

Weevils, having no legs, but all with a horny head and jaws. These larvæ in a shorter or longer time change into cocoons (pupæ) covered with a thin, transparent skin, out of which emerges the perfect Beetle.

Larvæ are like infant children, whose only occupation consists in eating, that they may grow and fulfill their destiny; but as they approach the time when they must appear in society as perfect creatures, they transform themselves into a cocoon (*pupa*), and sleep until Nature has clad them with a new and splendid dress, and furnished them with glistening wings to appear as respectable objects in the fashionable world of Insects.

In the nourishment of Beetles something more than the mere preservation of the individual seems to have been designed, and in many instances it would appear as if some were created for the express purpose of consuming unhealthy organized matter. Thus we find also the carnivorous Beetles beneficial to man by devouring other noxious insects, and even carrion—thus destroying decayed animal substances which would otherwise prove a fertile source of unhealthy exhalations. Beetles which feed on leaves, wood, fruits, and grain, are herbivorous, and are generally noxious to man. But even here we find Nature's great doctrine of compensation fully carried out. If we find many genera of insects (which is the case principally among the noxious Butterflies) so prolific that, if allowed to increase, they would devour all the vegetables on earth, and thus destroy all living beings by famine, we at the same time see how the Great Ruler of Nature has prevented their increase by making them the proper food of others.

The number of insects which feed on others is immense. But, in spite of the numberless enemies of their own class, they have still others. There are a countless host of insects that often destroy the trees, bushes, and vegetables of our gardens, fields, and forests, by eating their leaves, and

such are very generally despised on that account, much as we may admire their beautiful colors and motions. If we were able, we would destroy them all at once. But we forget that our trees, with all their beautiful foliage, are not more pleasing to us than the feathered warblers that build their nests on the branches, and gladden us with their happy songs. We should take from our groves and forests half their charm if we were to expel our Robins, Thrushes, Mocking-birds, Jays, Orioles, Tanagres, Finches, Black-birds, Cedar-birds, and many hundred others. And yet, were we to annihilate Caterpillars, our gardens, woods, and fields would soon be abandoned by the whole feathered tribe who feed on them, and melancholy sadness shroud the abodes of man. Ardently, then, would we long for the return of the noxious Caterpillars, and with them the joyous songsters of the forest. In like manner, we ignorantly despise, and contrive means to destroy many birds who devour our vegetables, without considering that they rid us of a much greater evil in destroying millions of mice and noxious insects—so beautifully is the doctrine of compensation illustrated throughout the Animal Kingdom, as well as in all the objects of Nature.

Now among the Beetles of prey, which feed on other living insects, I mention first the handsome LADY-BIRD (*Coccinella*), which is quite small, of a discoid form, and for the most part yellow or red, with or without spots; but some species are black. They look like colored turtles, and are known to every child. But few persons know that these little creatures are of great service in the economy of Nature. They are found upon all those trees and shrubs which are infested with the plant-lice (*Aphis*) which are so injurious to peach, pear, apple, and plum trees, and others, as well as rose-bushes and other shrubs, and they make their principal food of these disgusting and destructive creatures.

The grubs (*larvæ*) of the Lady-birds are much the most voracious, and on that account are armed with two very powerful jaws. They creep along on the leaves and branches of plants until they find plant-lice, among which they then ravage like wolves in a sheep-fold. When full grown, their body is generally half an inch long, of an oblong form and bluish color, with four or six yellow spots, which generally become black spots upon the red wing-covers of the perfect insect. They remain in the condition of larvæ about two weeks, when they fasten themselves upon a leaf, cast their skin, and metamorphose themselves into a variegated or ash-colored short cocoon, from which the perfect Lady-bird issues in about a fortnight.

A great variety of these insects are found throughout the whole world, but the largest species we have in North America is the Northern Lady-bird (*Coccinella borealis*, Fig. 3), which is principally found upon the leaves of the Pumpkin vine, and several other species of gourd (*Cucurbitaceæ*). Here they feed in company with their grubs, not on the leaves of any of these plants, as many believe, but on the plant-lice and the larvæ of the Squash-bug which abounds on those vines.

Figure 3.



Northern Lady-bird.

Many other species of this genus, which are found in this country, are named according to the number and form of the spots on their wing-covers. Thus we have

<i>Coccinella</i>	<i>bi-punctata</i> ,	}	and many others.
"	<i>immaculata</i> ,		
"	<i>ursina</i> ,		
"	<i>novem-punctata</i> ,		

These Beetles were, several years ago, recommended as a superior remedy for tooth-ache, which was said to be immediately cured by putting one or two mashed Lady-birds into the hollow tooth. I tried this application in two in-

stances, and the tooth-ache was immediately relieved; but whether the remedy, or the faith of the patient, acted therapeutically, or the tooth ceased aching of itself, I confess I do not pretend to know. Thousands of these insects may be gathered in summer with the greatest ease, and may be kept for many years in a bottle of alcohol, and if any one wishes to test the therapeutic value of the *Coccinella* he can try it.

Popular superstitions are sometimes beneficial in their results, and this has often been the case with the animals of which we speak. Thus the ancient Egyptians regarded as sacred a certain Dung Beetle (*Scarabæus Sacer*), because by feeding on putrid substances, and consuming them, it purified the air, and thus proved beneficial to man. For the same reason the Turkey-buzzard, on account of its destroying carrion, and the Ibis, on account of its devouring snakes, were considered as protected by the Gods. The Lady-birds have likewise been held in high estimation from the remotest ages. In Germany they have been called *Frauen*, or *Marien-Käfer* (Lady Beetles of the Virgin Mary); and in France *Vaches de Dieu*, or *Bêtes de la Vierge* (Cows of the Lord, or Animals of the Virgin).

Persons who have plants in their conservatories infested with plant-lice will easily get rid of them, and preserve their plants, by putting a number of Lady-birds, or their grubs, upon the plants. A very simple and a sure remedy for a very troublesome evil.

The TIGER BEETLE, another Beetle of prey, is so called on account of its variegated color and its rapacious propensity to devour every insect that comes in its way. It acts like the tiger among Mammalia, the hawk among Birds, the crocodile among Reptiles, or the shark among Fishes. They are ravenous wolves among insects, feeding on caterpillars, flies, other species of beetles and rain-worms, and will even devour one another when shut up together, which,

however, is done by all the insects, probably enraged at the idea of being made prisoners.

These Beetles have a cylindrical neck, an oval and flat abdomen, their wing-covers flat, their head thick, with large round eyes, long denticulated jaws, thread-like feelers, and their whole body is ornamented with the most splendid colors. They may be seen running upon dry, sandy ground, particularly at noon on sunny, warm days, but when one approaches them they fly away so quickly that it is quite difficult to catch them; they, however, soon alight again. When taken between the fingers, they discharge from their mouth a brown, fetid liquid, which has the odor of rancid grease. Their strong, pointed, and crossing jaws enable them to kill other insects with ease.

Their grubs are soft and white, but are provided with powerful jaws, and have the same rapacious nature as their parents. They dig perpendicular holes in the ground, and when driven by hunger come up just so as to have their round heads cover the entrance of their retreat, and here they wait until some insect passes over the hole, when they seize him in a moment and drag him into their cavern.

The Tiger Beetles, of which there exists many species in the United States varying in color and size, destroy a great multitude of noxious insects, and hence deserve to be respected and protected.

The two species of Tiger Beetles represented in Figs. 1 and 2 (*Cicindela repanda*, and *C. sexguttata*) were found near Cranston, Rhode Island, upon the sandy plains in the vicinity of the Stonington Railroad, but they are also found in all the Middle, Southern, and Western States of the Union, and with them many other kindred species.

The Tiger Beetles, or *Cicindela*, belong to a large family called "Carabi," which Dr. Bonelly (Mem. de Turin, 1809) has divided into many genera, and after him Professor Latreille (in Cuvier's Regne Animal) into many more; and

Count Dejean has written many volumes describing only their different forms.

Figure 4.



Green Caterpillar-hunter.

Figure 5.



Red-spotted Caterpillar-hunter.

The handsome CATERPILLAR-HUNTERS (*Calosoma scrutator*, Fig. 4, and *C. calidum*, Fig. 5) belong to the same family. I have given them this name because they may be seen every morning and evening upon the branches of trees, looking out for caterpillars and devouring them.

The real Carabi, which these animals resemble, are also distinguished by the same carnivorous habits, by their magnificent colors, and by generally being found under stones, or running swiftly over the sandy soil, on which latter account the Germans called them *Sandläufer* (Sand-runners). The countries of Europe produce a greater variety of these animals, principally in the Alps and all other mountainous regions; and the splendid, blue-colored, large Carabus (*Procrustes violaceus*) still brings to my mind the most pleasing recollections of the disinterested hospitality and affectionate kindness of the Tartars who dwell in the lovely Peninsula of the Crimea. It was in the month of June, 1825, that I visited that delightful country. The romantic valley of Baidar, covered with luxuriant and variegated flowers, and

a great variety of the most beautiful insects, offered me an immense field for collecting plants and insects, a catalogue of which I published in St. Petersburg in 1827. On the first excursion I made in that country, I was followed at a distance by a dozen mysterious-looking young Tartars, who, as soon as they perceived me picking up those violet-colored carabs from under the stones, and putting them into a vial, suddenly all disappeared. But judge of my astonishment, on my return in the evening, in finding a crowd of Tartars in front of my house. Had I been less acquainted with the kind feeling of those people, and particularly their hospitality toward strangers, I should certainly have witnessed that crowd with some alarm. But as I approached the house, a number of them walked solemnly toward me, the right hand on the breast, as a sign of salutation, and with the left presented me jars filled with these splendid carabs, as a token of their affection for me.

Nor was this all; for two days after, when I left Baidar for Theodosia, and when almost ten miles distant from the former place, I heard behind me the swift trotting of horsemen, and, turning round, met one of those friendly Tartars of Baidar, who had followed me for the purpose of presenting me another jar full of those carabs. No persuasion could induce any one of these Mohammedans to accept the least recompense for any service or for my board; and in all their villages and towns I was exceedingly annoyed by the inhabitants, for every one offered his house as my residence, from the tolerant Mullah, or Mohammedan priest, to the unsophisticated country peasant of Jenicale and Kertsch—the industrious manufacturers in the cities of Baktschiserai or Achmetschet, as well as the opulent merchant of Kosloff. All vied with each other in showing hospitality and munificence to the stranger. Would that stranger could repay them!

It may seem a long digression, but the lovely insects of that place, as they appear in my cabinet, or are pictured forth on canvas for the inspection of my readers, excite in me a thousand grateful emotions, that "come crowding thickly up for utterance." It is worth a visit to the Peninsula of the Crimea to behold these beautiful insects; it ten times repays one to make the acquaintance of its lovely inhabitants. The climate there is an eternal spring. The undulating soil is rich in all kinds of delicious fruits and vegetables—the scenery highly romantic, consisting of ancient castles in ruins, at the foot of which are seen domestic camels, and on the open fields before them herds of four-horned sheep. Here is

"The land of the cedar and vine,
Where the flowers ever blossom, the beams ever shine;
Where the citron and olive are fairest of fruit,
And the voice of the nightingale never is mute;
Where the tints of the earth and the hues of the sky,
In color though varied, in beauty may vie,
And the purple of ocean is deepest in dye;
Where the virgins are soft as the roses they twine,
And the spirit of man is all but divine!"

Although this terrestrial paradise now belongs to Russia, and its inhabitants have lost their national independence, still they have preserved their genuine Caucasian beauty; and while gazing with admiration upon them, it has often occurred to me that the Apollo of Belvedere, the Venus de Medicis, and the Madonna of Raphael must have been accurate copies of the men and women of the Crimea.

Their morals are not less to be admired than their beauty. Drunkenness, quarreling, riots, and murders are entirely unknown there. You may travel unarmed and laden with riches, from one end of the country to the other, without being molested; such a thing as a thief is never heard of there; and every where, in the cottage and in the palace,

you will be hospitably received and entertained as an old friend. If the rest of the world were more like the poor people of the Crimea, " 'twould be something." That country was conquered at the end of the last century by the famous Potemkin, the favorite of Catharine II., and its sovereign, the Khan, sent a prisoner to St. Petersburg, where he died.

In this connection, and at the risk of still further digressing from the subject-matter of this work, I feel it a duty incumbent upon me not to let this opportunity pass without doing an act of simple justice to the memory and the character of one of the most distinguished Naturalists of his time, Pallas, long a resident of the Crimea.

Only a short time since, the Hon. Samuel Arnold, Lieutenant-governor of Rhode Island, handed me Mr. Ditson's written work, entitled "Circassia, or a Tour to the Caucasus," in which I was surprised to find some statements which I knew to be erroneous, and which I can only account for from the superficial and one-sided view of things a traveler is liable to take who rapidly passes through a country and receives his impressions from only partial sources. But the erroneous impressions which Mr. Ditson conveys with regard to the world-renowned Naturalist, Pallas, particularly demand correction from me, because, during my residence in St. Petersburg, I was acquainted with his most intimate friends, and familiarly knew his whole life and character. Besides, afterward, at Simpheropol, in the Crimea, in 1825, I was hospitably received and entertained by Madame Caroline Ivanowna Pallas, the widow of that distinguished Philosopher, and from her own lips, of course, acquired the most accurate and reliable information with regard to herself and her husband.

Speaking of Baktschiserai, the former residence of the Khans of the Crimea, Mr. Ditson says: "In this vicinity lived Pallas, who came here and wrote his famous book of

travels, and so pleased the Empress Catharine by the glowing description he gave of the country, that she thought she could not reward him better than by giving him a portion of it, with an income of two thousand rubles: Pallas considered it but as a species of exile, and was overwhelmed. He saw that he was the dupe of a simple desire to make the newly-acquired territory grateful to his sovereign, and he sat himself down, without the power or courage to complain, suffering in body and mind till the shades of an unending night veiled him from the world."

Now the facts are these: Professor Pallas, Member of the Imperial Academy of Science at St. Petersburg, Councilor of State, and Knight of several Orders, was born in 1741, at Berlin, where he acquired a distinguished reputation by his researches and writings on Natural History. When the Empress Catharine II. of Russia learned the fame of this great man, and his eminence in his department of science, she invited him to her court, and then proposed to him, as a Naturalist, to survey Siberia, the Crimea, and the Cis and Trans-Caucasian provinces. He accepted her proposition, and spent several years in traveling through the countries, all the while being recompensed in a princely manner by the Empress, and journeying in the greatest style and expense. His many classical and valuable works with regard to the Zoology and Botany of those provinces, published in French, German, and the Russian languages, were the result of his extensive labors, and to this day attest his eminent ability in the department of Natural History.

On his return to St. Petersburg he offered to sell his large collection of natural productions for the sum of fifteen thousand rubles; but when the Empress heard of it she wrote him, telling him that he knew very well how to write a learned work, but that he did not know how to make a calculation, for his cabinet was worth twenty thou-

sand rubles, and that she would be purchaser of it at that price under one condition, viz., that the cabinet should remain in his house for his use as long as he lived. Accordingly, she accompanied her letter to Pallas with the twenty thousand rubles.

This delicate and munificent present of the Empress was followed by her settling upon him large estates in the Crimea, where he preferred to reside; but a great portion of these estates he sold, after the death of the Empress, to the famous Armenian, Natarra, who owned the large crown-diamond of Shack Nadir of Persia, which was purchased by Catharine, and is still now seen in the Hermitage among the other crown-jewels.

In view of all these facts, we can not understand how Pallas became a dupe of the Russian Government, or could consider himself as exiled to the Crimea, as Mr. Ditson says. It was not so, as he resided there only when he preferred it; and after the death of the Empress, when he was over sixty years old, he became anxious to see his fatherland once more. Accordingly, he settled on his wife, who preferred to remain there, a very fine estate near Simpheropol, and he went to Berlin, his native place, where he died at the age of seventy years.

Pallas was twice married. He had by his first wife only one daughter, who was married to Count Wimpfen, a General in the Russian army, who was killed, in 1805, on the battle-field of Austerlitz. His second wife was still alive, and resident in the Crimea, in 1825, when I was there. Although over sixty years of age, she was the life of society, a lady of great intellectual attainment, and an accomplished scholar. She spoke fluently the Russian, French, Italian, German, and Tartar languages.

We have already remarked, in the lives of the Insects under consideration, that they afford a constant evidence of the working of Nature's great law of antagonization—

the one undoing what the other does; the injuries which one species would inflict upon man are checked by other species, which prevent their superabundance, and keep an even balance in the scale of being.

Hence this law of antagonization is, in its effects, the law of Compensation. Thus we see Tiger Beetles, Carabi, Lady-birds, and many other Coleoptera, destined to benefit mankind by devouring other insects which are noxious. Of these we have already spoken. But a mere negative usefulness is not the only one belonging to this order. There are also many other Beetles which render us the greatest service by devouring putrid substances, carrion, decomposed fermenting plants, mushrooms, dung, and decayed wood, as, for instance, the Dung Beetles, Carrion Beetles, and many others.

Now the food of Beetles in general has suggested to us the idea of dividing them into three Natural Families, according to the nourishment which they subsist upon, and this division seems to us the simplest, most uniform, and the most rational, as well as the only really natural division. Accordingly, I classify all the Coleoptera under one of the three following families:

1. *Carnivorous Beetles*, which, like Lions and Tigers among Beasts, prey upon living Insects; as presented in Figure 3.
2. *Scavenger Beetles*, which live on putrid matter, carrion, decayed wood, and plants; as those represented in Figures 6, 7, 8, 9, and 10.
3. *Herbivorous Beetles*, which feed on Plants and Fruits, as Snout Beetles, or Weevils, Capricorn Beetles, etc.

The first two families are useful to man, and deserve our protection; but the last are noxious, and should be destroyed wherever encountered.

The distinguished French Entomologist, Latreille, divided Beetles into five tribes, according to the number of joints found on their feet. Thus he called those that have five

joints, *Pentamera*; those with four on the hind feet and five on the fore feet, *Heteromera*; those with four, *Tetramera*; with three, *Trimera*; and those with two joints, *Dimera*.

This division, although as convenient as the artificial classification of Plants by Linnæus, according to the number of stamens, is still subject to the same incongruities. Both in the system of Latreille and in that of Linnæus, we find arranged in one and the same class individuals which do not and can not coincide with each other, neither in their external form nor in their nature. Thus, in the Linnæan system, the Crocus and Wheat occur in the same class, *Triandria*, simply because each of these plants has three stamens; but what an immense difference is there between them in their properties, and even in their external forms! Many others occur in the same class which are equally incongruous. So also in the artificial system of Latreille. The Tiger Beetles and the May Beetles belong to one and the same family, which he calls *Pentamera*, because both have five joints on their feet; but they are very unlike each other in their forms and in their natural disposition; the one is carnivorous, the other herbivorous; the one is useful, the other injurious to vegetation. For these reasons we prefer our natural classification according to their food, and hence according to their natural disposition. Of the first family, the Carnivorous Beetles, we have already spoken, and we proceed to the second family.

Scavenger Beetles.

The body of most all of the Scavenger Beetles is very hard, and their feet very strong, adapted for digging. They deposit their eggs in manure, or rotten wood, or carrion, or in the ground, and in some instances the grubs (*larvæ*) proceeding from these eggs live several years in these substances before they are metamorphosed into perfect beetles, as in the case with the Stag Beetle.

In this family we find the largest Beetles, as, for instance, the Hercules of South America, which is five inches long. Many of them, also, are remarkable for their very singular forms. Upon their thorax or head we generally notice several horns, which are used to facilitate the process of digging, and the antennæ in many of them terminate in a knob, which consists of from three to seven leafy pieces (*lamellæ*), which they fold or unfold at pleasure, like a fan. These last are on this account called *Lamellicornes*.

Notwithstanding some of these insects dwell in the most disgusting and filthy abodes, from which also they take their nourishment, they are still very clean in their appearance, and generally very bright in their color. Their olfactory organs are very powerful and of great extent, for scarcely a horse or cow drops its dung in a pasture but we see them flying to it from all directions, digging themselves into it, working it up, and making holes under it in the ground, into which they deposit their eggs, or making balls of it like the Tumble-bug.

The larvæ of these insects live under ground, and feed on the parts of their dwellings, viz., on manure, decayed wood or carrion, or roots. They are of a cylindrical form, somewhat thicker behind, and round, and consist of twelve generally pale yellow-colored ringlets: their head is horny; they have two strong jaws and six legs. On each side of the body are the breathing organs, consisting of nine holes, the same as in caterpillars. Their back is generally curved, and hence they can not stretch themselves out or walk upon level ground. Many of them live in this seemingly pitiful condition for several years before they change into a cocoon (*pupa*); then, with the material of their dwellings, which they anoint with a gelatinous substance coming from their bodies, they form an oblong cocoon, into which they gather themselves, and remain safe from all external influences, until after a longer or shorter time their

metamorphosis is complete, and they emerge as perfect Beetles.

A number of such larvæ were considered by the ancient Romans as a wholesome and delicious article of food, and even fried and eaten by them, in the same manner as the inhabitants of the West India Islands now do with the Palm-worm, which is a disgusting-looking, fat larva, from three to five inches long. This larva lives in the stem of the Palm-tree, usually in the Cabbage Palm (*Areca oleracea*), and afterward changes into a black weevil two inches long (*Calandra palmarum*), which, however, belongs to the herbivorous Beetles, of which we shall speak hereafter.

The gigantic beetles of this family, some of which are from three to five inches long, are found in the tropics of America, Asia, and Africa, and, from their size and magnificent colors, as well as from the oddity of their appearance in contrast with those of other climes, form great ornaments in an Entomological cabinet. They are as rare in the insect world as are the Elephants, Rhinoceroses, and River Horses among beasts; and enthusiastic entomologists have often paid very considerable sums of money for them.

It is not wonderful, then, that these beautiful ornaments of Creation have so excited the admiration of scientific men as to lead to a complete mania for collecting and preserving them—as actually to make the observation of Insects, and the study of their nature and use, the ruling passion of their lives. The immortal Reaumur established on his estate houses, or rather nurseries, for insects, and paid servants for attending to them, he himself watching them night and day, in order to become perfectly acquainted with their manner of living. His “*Mémoires des Insectes*,” published in Paris, 1734, abound with the most curious and interesting observations.

General Count Déjeau, Aid-de-camp to Napoleon Bona-

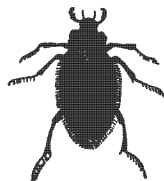
parte, was so anxious to increase the number of specimens in his entomological cabinet, that he even availed himself of his military campaigns for this purpose, and was continually occupied in collecting insects and fastening them with pins on the outside of his hat, which was always covered with them. The Emperor, as well as the whole army, were accustomed to see General Déjeau's head thus singularly ornamented even when in battle. But the departed spirits of those murdered insects once had their revenge on him; for, in the battle of Wagram, in 1809, and while he was at the side of Napoleon, a shot from the enemy struck Déjeau's head, and precipitated him senseless from his horse. Soon, however, recovering from the shock, and being asked by the Emperor if he was still alive, he answered, "I am not dead; but, alas! my insects are all gone!" for his hat was literally torn to pieces. Six years after this, in 1815, I met Count Déjeau as an exile at Fiume, on the Adriatic, and made several entomological excursions with him.

The celebrated Prince Paul of Würtemberg, another passionate Naturalist, whom I met in 1829 at Port-au-Prince, being one day at my house, shed tears of envy when I showed him the gigantic beetle *Actæon*, which, only a short time before, had been presented to me by the Haytien Admiral Banajotti, he having found it at the foot of a Cocoa-nut Palm-tree on his plantation.

The BRONZE DUNG BEETLE (*Copris carnifex*).—This is one of the most splendid Scavenger Beetles of North America, and is found in horse and cow dung on our roads, and in our meadows and pastures. It is about three-quarters of an inch long, and has a short, vaulted body without a scutel, that is, without that little triangular horny plate between the upper parts of the two wing-covers, which we find in so many others; for instance, in the *Cetonia* (Figs. 8 and 9). Its antennæ are short, and terminate in a knob

composed of leaf-like pieces, which can be folded or unfolded, like a fan, at the pleasure of the animal. The thorax and head are externally chased, and of an antique bronze color. The head is semicircular, with a purple border on the margin, and in the male with a short perpendicular horn. The wing-covers are striated, and of a changeable green color. The feet black, hairy, and strong, calculated for digging holes.

Figure 6.



The Bronze Dung Beetle.

This Beetle, like all others of this family, contributes much toward purifying the air, by feeding on putrid, unwholesome substances. It acts in the same manner, and produces the same effect, as those larvæ of insects which live in the water and purify it. The experiment of Linnaeus is perhaps familiar to all. He filled two vessels with fetid, putrid water, and into one he put the larvæ of Gnats, Dragon-flies, and Ephemeræ, and left the other standing. In a short time the water in the first vessel, which was full of larvæ, was found pure, and entirely devoid of smell, while the other continued as fetid and as putrid as before. This experiment can be repeated to the satisfaction of every one who chooses to make it.

The Bronze Dung Beetle is found in great numbers during the latter part of summer and in the autumn, more in the Southern and Western States than in the North and East, and for the very obvious reason that its presence is more wanted in the warmer climates, where the air is more apt to become infected by decayed and putrid matter.

Another use may be made of this insect, and one which I may mention particularly for the young ladies and gentlemen who may read these pages. By taking off its handsome wing-covers, thorax, and head, and gluing them close to each other on the outside of a fancy box, you will have a beautifully variegated surface, glistening with green and

red, which will shine brilliantly when varnished, and will excite the curiosity of every one. If you can not find wing-covers enough of this insect, take those also of Tiger Beetles, Lady-bugs, Carabi, Cetonias, and a hundred others with bright colors, and you will have a variety of colors such as Nature only can paint, and such as can not fail to captivate the eye of every observer, or to reward you for your trouble. Such occupation would form a delightful amusement for the long winter evenings; and while storms and snows are raging without, what more genial employment than to be admiring the creatures of a sunny clime and studying the character and uses of these spangled ornaments of Nature's tropical dress!

Now, in order to accomplish this, you must amuse yourselves during the summer by catching Beetles and preserving them. You will find hundreds of them running in the roads, or concealed under stones, or sitting on the leaves of plants, or flying in the air. If you keep your windows open during the warm nights also, those insects which are active only at night will fly into the room toward the light, and may thus be taken by the hand, for none of the Beetles are venomous. But in order to preserve them and make them die as quick as possible, you must be provided with a wide-mouthed bottle (a horse-radish vial answers this purpose very well), containing a small quantity of whisky or dilute alcohol, and put them into it as soon as caught. When they are dead take them out, and stick a long pin or needle through the right wing and body, so far that their legs can not touch the bottom, and then place them in a box the bottom of which is lined with beeswax or cork. In order to prevent the entrance of destructive living insects, it is also necessary to stick a pin in each corner of the box, with a piece of sponge on it, which you must from time to time saturate with spirits of camphor. Beetles may be also kept in a vial of whisky or alcohol, and thus be preserved for

many years, and transported thousands of miles without injury. I have been thus particular in these details because I am often asked how to catch and preserve these insects.

Another species of Dung Beetle, very beneficial in the same way, and well known to every child, is the funny TUMBLE-BUG, or Pellet Beetle (*Ateuchus volvens*), which is found in all the States of the Union, and in fact similar ones are found in all parts of the world. Pliny, speaking of that species which is found in Italy, says: "*Aliud scarabæorum genus, qui e fimo ingentes pilos aversis pedibus volutant, parvosque in iis contra rigorem hiemis vermiculos foctus sui nidulantur.*"

The Pellet Beetle of North America is half an inch long, of a black, and some of them of a changeable green or purple color, exhaling a fetid odor, slightly resembling that of musk. These Beetles are complete models of industry and parental care, for they are continually occupied in making small balls of fresh manure, about the size of a common marble, which they mix with earth, and into which they deposit an egg. As soon as the ball is dry they roll it and roll it, until they find a convenient place for making a hole two or three feet deep, into which they roll it, and then bury up their offspring, the precious object of so much care.

The ancient Egyptians were so convinced of the benefit derived from these insects, that they considered Pellet Beetles as sacred, and usually represented them in their temples, obelisks, and statues. They are also found even in their mummeries. The *Ateuchus sacer* of the Egyptians, however, although of the same character and habits as our Pellet Beetle, is twice as large, and is also black. It is found not only in Egypt; I saw it also in France, Italy, the Crimea, and along the Caucasus.

We come now to a species of insects which are in rather bad repute among farmers, because they feed on decayed

wood, and because some of them deposit their eggs in the crevices of the bark of many trees. I do not here speak of the destructive Wood-borers or Weevils, but only of those insects which feed on decayed or rotten wood; and if our farmers call these creatures wood-destroyers, I think the beetles may with more propriety apply the epithet to the farmers themselves, who really destroy an immense amount of timber unnecessarily, and even hire men to help them do so. I allude to the common practice of inclosing our lands with expensive wood fences, which, indeed, may be necessary in a newly-settled country like the Far West, but which are not at all necessary in our old, well-cultivated States.

I am aware that this subject has been somewhat agitated of late among agriculturists, and I trust these remarks may reach the ears of some who will be convinced, with me, that the practice of laying out whole farms with these expensive inclosures is a wasteful, extravagant throwing away of wood. I believe it to be a fact that, if our country had not been wonderfully favored with inexhaustible coal-mines, our woodlands would long ago have been deprived of their trees, and fuel would have to be sold by the pound. Now our farmers not only incur the expense of timber and manual labor in building these wooden fences, but they must be at the additional expense of repairing them every year; and if all this were entirely avoided they would actually realize more benefit from their estates. It is true that if there are no fences in the country the cattle must stay at home, lest they injure the fields and meadows, and that every farmer on this continent would be obliged to resort to stall-feeding, and keep his cows, oxen, hogs, etc., in the barn-yards. But by doing so he will be the gainer, for he will save, first, his timber; second, the wages for making his fences; third, his cows, by being kept at home, will produce more milk, butter, and cheese; fourth, he will save

a large amount of manure, which he loses if his cattle are allowed to ramble in the woods and pastures; and, lastly, by having no inclosures, except around his garden and orchards (and hedges are even here far better than fences), he will beautify his whole estate and country by depriving it of that confined and prison-like appearance which wood fences and stone walls necessarily give it.

It is a very difficult matter to eradicate inveterate superstitions, and it is equally hard to break up old habits. Notwithstanding the plow has been used from time almost immemorial, the inhabitants of St. Domingo have not yet adopted it, but still prefer the hoe and spade, and to hoe and plant an acre of Indian corn is there the work of four weeks for one man. But "a word to the wise should be sufficient."

With regard to wood-destroying insects in general, it must be remarked that they are of the greatest importance in the tropics, as well as in those uninhabited countries where many hundred miles are often covered with impenetrable forests, where hurricanes, tempests, and earthquakes break down gigantic trees, which, if left alone, would not decay for years, but which are reduced to dust in a short time by wood-eating insects, and a new and vigorous vegetation springs up from the soil made fertile by that dust. This phenomenon may be observed to a certain extent even in our own woods.

One of these Beetles, which, in company with its offspring, feeds on rotten wood, is

THE HORNED PASSALUS (*Passalus cornutus*).—This Beetle is about $1\frac{1}{4}$ inches long. It is black, and has a slender body. Its antennæ are rather more denticulated than those of the

Figure 7.



Horned Passalus.

Lamellicorn. Its head is very short, but provided with a curved horn two lines in length. It has two very short, pincher-like jaws, a bright, vaulted thorax, with an intermediate line, wing-covers striated and very bright, and six short legs, covered with brown hair. It lives in the trunks of decayed trees, and is found in all parts of our country, from New England to Mexico and the West India Islands. Nearly allied to this insect, and very much resembling it in many respects, is

The **STAG BEETLE** (*Lucanus dama*).—This is an insect known to almost every body. It is an inch and a half long, of a chestnut color, with prominent pincher-like jaws, which, however, in the female, are very short, and not larger than those of the Horned Passalus. Its legs are quite long, and terminate in two sharp claws.

They are called Stag Beetles on account of their pronged jaws, similar to the horns of stags. They live principally upon oak trees, and lick the dew from the trees, as well as the sweet brown juice which oozes out from the stem of oak trees, and if you put honey on the point of a knife they will follow after it, as a dog will follow a piece of meat. They may be seen flying around these trees toward night in the months of July and August.

These Beetles are well known to our youth, and attract their attention by their singular form, but particularly by their prominent jaws, with which they pinch very hard. Wood-cutters often bring them home as playthings for their children, for which present, however, the little fellows sometimes have to pay with their tears. In some countries the boys make tiny wagons, which they load with cherries or raspberries, and to which, for their amusement, they harness these Beetles, making them as beasts of draught.

In the month of June or July, according to the temperature of the country, the Stag Beetle deposits in decayed oak wood her eggs, which are oval and yellow, the larvæ

proceeding from which live from four to six years before they become perfect. When full grown, they are three inches long, thick, of a straw color, with a yellow head, brown jaws, and nine air-holes on each side of the body.

Two years ago I removed the post of my garden gate, which was of oak and had become decayed, and found around it, below the surface of the ground, more than thirty of these grubs, which I put in a vessel with the same decayed wood, but they died during the winter.

The Stag Beetle of Europe is of the same form and color, but more than as large again, and is therefore the largest Beetle of Europe.

The *Cossus* (grubs), which the ancient Romans considered so great a delicacy, were taken by them from oak-trees, and were probably the same species. Pliny says, "*Praegrandes roborum delicatesiores sunt in cibo: Cossos vocant.*"

The larva of the Stag Beetle, when full grown, prepares from the earth its cocoon, which is of an oval form, and in which it remains about four weeks, after which time it emerges as a perfect insect. These Beetles are found in all the States of the Union.

The INDIAN CETONIA (*Cetonia Inda*).—One of the earliest Beetles which the wandering naturalist meets on his exploring expeditions is the pretty Indian Cetonia. These little creatures, clad in a modest copper-brown dress, and covered with short hairs, are seen, in the months of April and May, flying like bumble-bees for short distances only and then alighting in the sand. Their beauty and their early appearance very generally awaken the pleasant anticipations of a tropical temperature.

Several years ago I made an excursion on the first day of May with a young gentleman from Germany, an enthusiastic amateur in Entomology and Natural History gener-

Figure 8.



Indian Cetonia.

ally, like most of the students of the Old Country. All at once he stopped, bent down to the ground and picked up one of these little *Cetonias*, and, holding it up in his hand, he exclaimed in ecstasy, as if addressing the dearest object of his heart :

“Der erste Tag im Monat May
Ist mir der glücklichste von allen,
Dich sah ich, und gestand dir frei
Am ersten Tag im Monat May,
Dass dir mein Herz gewogen sei.
Hat mein Geständniss dir gefallen,
So ist der erste Tag im Monat May,
Für mich der glücklichste von allen.”

Which, translated, reads: “The first day of the month of May is the happiest day of all to me. ’Twas on that day I first beheld thee and my heart confessed me thine. If my confession pleases thee, then ever will the first day of the month of May be the happiest of all the days to me.”

This little insect is about half an inch long, and feeds upon the pollen of the stamens of flowers—it sucks also the sap of trees, principally that of willows, and deposits its eggs at the side of roads, or in places where garden weeds are heaped up, and in decayed wood. Its larvæ feed on different kinds of roots. Reasoning from analogy with the nature of other species of *Cetonia*, I should conclude that the larvæ of this Beetle continue in that condition upward of three years before they become perfect Beetles.

Figure 9.



Fox-like Cetonia.

The FOX-LIKE CETONIA (*Amphicoma vulpina*), Fig. 9, is also a native of North America. It is of about the same size as the Indian *Cetonia*, but more slender, and covered all over with long reddish hair, resembling a fox.

Another insect belonging to the family

of Scavenger Beetles is the horned FUNGUS EATER (*Boletophagus cornutus*), which feeds not only on decayed fungus and mushrooms, but also on decayed wood. The male and female species of this insect I have lately received from my esteemed friend, David Smith, M.D., of Providence, from whose entomological researches I have obtained many interesting facts, and to whose kindness I am indebted for the free use of his valuable library.

This insect is represented by the late Thomas Say, in his *American Entomology*, Plate 51, without, however, making any mention of its habits, use, or injury.

The Fungus Eater is about half an inch long, and is remarkable for its singular form. Its head has two little horns upon its margin, which are curved backward and inward, resembling that of a Babyroussa. Its thorax has two larger horns, which are curved and directed forward, looking like a bull's head, and its wing-covers are surmounted by so many tubercles that their whole appearance is like that of a Turkish country metshet or mosque, covered with a number of small minarets or spires.

The body of this animal is of a dark ash-color and hairy, and it lives principally in fungi and in decayed wood.

Another, and a very important class of insects, belonging to this family, are the CARRION BEETLES, which feed on dead or dried animal bodies, of the higher as well as the lower classes. They eat the flesh, fat, skin, and intestines of dead beasts, birds, fishes, and the internal parts of preserved insects. Hence we see very few of them, for they bore into those bodies and conceal themselves in them, devouring their decayed parts, and depositing their eggs in them. Those who will dare encounter fetid exhalations and will take the trouble to examine the putrid cadavers of horses or cows, or any other dead animal that is left exposed to the air, will find a very large company of Carrion Beetles, of different genera and species, in a variety of

different uniforms; some looking like martial officers, ornamented with one or two golden epaulets; others, like chamberlains of a despotic sovereign, ornamented with a golden royal chamber-key on their side; others in ordinary working dress, and altogether quite respectable and corpulent in their appearance, because they, like the persons they so much resemble, live also on the fat of their fellow-creatures.

Now the greatest part of these Beetles, as I have already mentioned, are very beneficial to man, by consuming carrion and all decomposing substances. But there is one particular genus of them against which the naturalist always makes war, notwithstanding it is not larger than two-thirds of a line. This small insect is called the Cabinet Beetle (*Anthrenus muscorum*), and is of a dark-brown color, covered with gray scales forming three stripes across the wing-covers. If these scales are wiped off the insect appears black, and loses its specific character.

In spite of its diminutive size this insect is a great plague to all cabinets of Natural History, and if they are not well protected against it, they will all be destroyed by it in a short time; for its larvæ are able to make holes through the hardest boards, and will make their way unperceived into any case whatever. They eat the skins of stuffed animals, and particularly the internal parts of insects, of which they leave nothing but the wings. Thus the most precious and costly collections will be entirely destroyed by it, if the necessary precautions are not taken to prevent it.

The late General Andrew Jackson, President of the United States, presented me in 1834 with two large boxes of splendid South American Beetles and Butterflies, but, much to my regret, on opening them I found the largest and handsomest specimens destroyed by this little enemy of naturalists. I succeeded, however, in saving a large number of them from entire destruction by putting them

into alcohol, and by making artificial heads and bodies out of cork, and then painting them and fastening the wings to them with gum-arabic.

In order, therefore, to prevent your cases of insects from being destroyed by this Cabinet Beetle, it is necessary to have the lining of the boxes, whether it be of cork or wax, well impregnated with spirits of turpentine, and, besides this, it will be well to fasten in each corner of the box a pin with a small piece of sponge attached to it, which may be saturated from time to time with the same fluid, or with spirits of camphor. The latter, however, can not be used in cases which contain butterflies, as the evaporation of camphor will make their colors fade. The cases themselves, as a matter of course, should be made as tight as possible, in order to prevent the entrance of any living insect.

The larva of the Cabinet Beetle is two lines in length, and has on each side of the body little bundles of reddish-brown hairs, which, when disturbed, it erects in the same manner as the Porcupine does its quills. These larvæ are sometimes seen upon our walls looking out for dead insects.

The CARRION BEETLES (*Silphæ*) have a broad body, with a shield-like thorax, upon which is a declining head with strong jaws, and with antennæ terminating in a knob. A great number of species are found every where in North America, among which are, for instance, the

Silpha marginalis,
“ *inæqualis*,
“ *Surinamensis*,
“ *Americana*, etc. ;

but as the habits and character of one species are identical with all the others, the representation and description of one will serve for all the rest.

The CRUSADER CARRION BEETLE (*Silpha Americana*) is more than half an inch long, has a black head, yellow tho-

rax, with a large black spot resembling a cross in the mid-

Figure 10.



Crusader Carrion
Beetle.

dle, somewhat like that on the coat of the ancient Crusaders, on which account I give it this name. It has dark-brown chased wing-covers and black legs. These insects live together in flocks of immense numbers in the body of some carrion, where they feed together in the greatest harmony; and they may always be obtained with ease, provided one will put up with the fetid exhalations which surround them.

Another insect belonging to this family of Scavenger Beetles, and one which has a similar appetite for decayed animal substance, is

The BIG GRAVE-DIGGER (*Necrophorus grandis*), of which there are also several species. This Beetle has a large black head, with antennæ terminating in an orange-colored knob, a round black thorax, and orange-colored truncated wing-covers, with an undulating black band crossing the middle of both wings. The habits of this animal are very curious and astonishing.

The dead body of a frog, mouse, bird, mole, snake, or toad, lying in a garden, field, or meadow, is immediately scented by these Grave-diggers, who run to it in great numbers in order to conceal it in the ground. First they run around it, and examine it from all sides, as if they wished to measure its size; then they proceed to examine the ground to see if there are any stones in it which would prevent them from digging. Finally, after having selected a place well adapted for their purpose, they by their combined efforts move the carrion there, placing themselves under it, and by lifting it up with their head and thorax they at the same time dig the earth away with their fore-feet, so that the carrion gradually sinks into the ground. From time to time one or the other of the Beetles come out

from beneath, as if to examine the position and progress of the dead body ; then, creeping under it again, the work recommences in concert. After about three hours of hard labor, the body—for instance, that of a frog—is so far buried that it can not be seen from the surface of the ground. They then continue their labors in this manner for several days, until the carrion is sunk about a foot in the ground, and this they do probably in order to prevent the Meat-fly from depositing her eggs upon it.

The female Grave-digger deposits in the carrion about thirty eggs, which are white, cylindrical, and have a short filament at each extremity. These are hatched in about two weeks, and the larvæ proceeding from them attain their full growth after four weeks more. At this period they quit the dead body, go deeper into the ground, and form their cocoons, from which, after about four weeks, they issue as perfect Beetles.

The immortal Rösel, in his "*Insecten Belustigung*" (Amusements with Insects), 1748–1761, has made some very interesting and profound observations with regard to this insect, which all would be pleased to hear, but which our limits forbid us to relate.

We proceed, then, to the third natural family of the Coleoptera.

Herbivorous Beetles, or Plant Eaters.

The Herbivorous Beetles are all provided with a horny skin and very hard wing-covers. Both as grubs and as perfect Beetles they feed on vegetable substances. Some on green wood, as the Spring and Capricorn Beetles ; some on fruit and seeds, as the different kinds of Weevils or Snout Beetles ; and others on leaves, as the Cucumber Beetle.

As these insects infringe the privileged prerogatives of man, who, like every kingly despot, imagines that every

living being in his dominion was created only for his sake—as they destroy the wood destined for our fences, fuel, and furniture—as they devour our cherries, pears, apples, plums, chestnuts, peas, rice, and wheat, and all our fruit—as they eat up the leaves of our garden, orchard, and fruit trees, they are, and always have been, considered as the enemies of mankind. A universal war is carried on against them, and agricultural and horticultural journals are filled with recipes of different preparations, and directions for their destruction, like our newspapers with panaceas for consumption, rheumatism, and all other “ills which flesh is heir to.”

But, after all, it has been the entomologist who, by his indefatigable researches and observations, has discovered their real benefit or injury, that has protected man against them, and them against man; it was he who looked for their abodes, learned their habits, character, mode of propagation, and duration of life; it was he who discovered their use or their injury, and taught mankind the use which can be made of the beneficial ones, and the only sure means of preventing the baleful ravages of the noxious ones. It is for this purpose that the naturalist collects them, even the smallest insects that live, preserves them in his cabinet, watches them with unwearied care and perseverance, and acquaints his fellow-men with the results of his laborious researches.

Such a philosopher was in ancient times, and, I am sorry to add, is even now in modern times, too apt to be considered by the ignorant and money-loving, money-making mass of the people as a trifling enthusiast, too lazy to work for his bread; and should he sacrifice his time and his pecuniary means in these benevolent and truly philanthropic labors, he is without gratitude, or even sympathy, from those he most benefits, living only on the hope and the consciousness that future generations will reward the ingratitude of

the present, instead of being, as he deserves, honored for his self-denying devotion, loved as a friend, and recompensed as a benefactor. Such things may be excused in the ignorant; but why is it that in our so-called Halls of Learning so little attention is paid to the study of the objects of Nature, to their remarkable properties, and their wonderful organization, to the faculties which distinguish them from all others, to their reciprocal affinities and harmonies, and to the great chain which unites them all?

The fact that the study of Nature tends directly to the civilization of a nation was well understood, more than a century and a half ago, by that ingenious, self-made man, Peter the Great, of Russia. He conceived the idea that a love for this department of science would contribute much toward the civilization and refinement of his barbarian subjects, and accordingly he established, at an enormous expense, a large museum of Natural History at St. Petersburg; and in order to induce his whisky-loving subjects to go there, he ordered a glass of brandy to be presented to every visitor.

That Muscovite barbarian certainly exhibited more common sense than the Congressman, in our modern time, to whom Wilson showed his work on American Ornithology, and who replied, "We do not at all want such books, for any one can see birds every day in our woods and orchards, without paying one penny for it."

But to return to the Herbivorous Beetles. The first of which we shall speak are the SPRING BEETLES (*Elatér*), which are also called Skippers, or Snapping-bugs. They are distinguished from all others by having an organ by means of which they are enabled, when laid on their backs, to spring up into the air and recover their standing posture, which they could not otherwise effect, as their legs are very short. This organ is on the under side of the thorax, between the fore-legs, directed toward the extremity of the

hind body, and ending in a point which is inclosed in a sheath while the animal is erect. When, therefore, this insect is laid upon its back, it bends its thorax and head, and, at the other extremity, its hind body backward toward the surface upon which it is laid, which motion causes its spring to fly out of its sheath, like the spring of a watch, and throws the Beetle perpendicularly up in the air a distance of several inches. If they do not succeed the first time in recovering their standing posture, they repeat the operation perseveringly until they do, oftentimes to the great amusement of the children, who catch them and lay them on their backs in their hands.

These insects generally deposit their eggs in the crevices of the bark of decaying trees, where their larvæ live several years before they become perfect Beetles. A few of the smaller species, whose larvæ live in the ground and feed on roots, may become somewhat injurious to vegetation.

There are many species of Spring Beetles on this continent, which may be distinguished by their size, color, and antennæ. The largest and handsomest in the United States is

Figure 11.



Velvet-spotted Spring Beetle.

The VELVET-SPOTTED SPRING BEETLE (*Elgter oculatus*).—This insect is about one and a half inches long, and slender: some species are longer, and others shorter than this. Its head, like that of all its kindred species, is very small, and looks as if it were sunken in the thorax, which is large, and composes about one-third of its whole body. It is of a light brownish color, sprinkled here and there with white spots. It is called in Latin *oculatus*, or

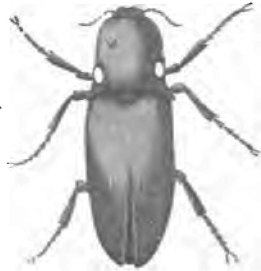
eyed, because each side of its thorax is ornamented with a large circular black spot, which looks like an eye. But as its eyes are in its head, like all the others, I have thought best to give it a more correct English name, and accordingly, from the resemblance of its spots to velvet, I call it the Velvet-spotted Spring Beetle.

This Beetle is seen in all the States of the Union, but more in the South than at the North. It is found mostly in the trunks of trees, where its larvæ also reside. The larvæ have flat bodies, of an orange color, and they live several years in this condition before they become perfect Beetles.

The LIGHTNING SPRING BEETLE (*Elater noctilucus*) is another species of the same genus, and has a far more appropriate Latin name, *noctilucus*, or night-illuminating, but its common name in English is the Cucujo. This insect is nearly an inch and a half long, and half an inch wide. It has two yellow, elevated, corn-like spots upon each side of the thorax, which are the principal organs for emitting light, and which appear, when alive, like two shining emeralds. But besides these spots, it also emits light from every segment of the under side of its hind body. This light the animal can produce at pleasure, and when there are eight or ten of them in one glass, it is strong enough to enable a person to read by it.

Some months since a lady presented me two of these living Lightning Beetles, which she had received from Cuba. I kept them in a glass, and exhibited them in a dark room to several of my friends, who were much astonished and delighted at being able to see to read by the light issuing

Figure 12.



Lightning Spring Beetle.

from them. I nourished them with great care, feeding them with sugar, their favorite food, but they died in about ten days, and with their life disappeared also their light.

I feel peculiarly grateful to these little insects, because during my excursions in St. Domingo they were frequently the means of saving my life. Often has dark night surrounded me in the midst of a desert forest, or on the mountains, when these little animals were my only guide, and by their welcome light I have discovered a path for my horse which has led me safely on my journey. Often have I felt grateful to a wise Providence for the creation of these little night-illuminators, when all the lamps of heaven were shrouded with impenetrable darkness, and when, but for their light-giving presence, I should have wandered for hours in a dreary forest, or been precipitated from a mountain ridge down a fathomless abyss. Thrice often have I been convinced that no object of Nature was created without being designed for some important use, and many, many times, in my wanderings, have I exclaimed with Southey,

"Sorrowing we beheld
The night come on: but soon did night display
More wonders than it vail'd: innumerable tribes
From the wood-cover swarmed, and darkness made
Their beauties visible; a while they streamed
A bright blue radiance upon flowers that closed
Their gorgeous colors from the eye of day;
Then, motionless and dark, eluded search,
Self-shrouded; and anon, starring the sky,
Rose like a shower of fire."

These Lightning Beetles are found in all the West India Islands, in Mexico, and Texas, and how far north they are seen I can not exactly ascertain, but several species of them, possessing the same luminous qualities, are found in the tropics of America.

Their light is emitted from a phosphorescent substance,

which forms one of the constituent ingredients of their bodies, and which they can exhibit or not, at pleasure. With this substance this species of Beetle act very much in the same manner as the Chameleon and other lizards do with the fluids of their body, by means of which they change their color as often and as rapidly as they wish. That this phosphorescent substance is an ingredient of their bodies may be determined by mashing them, even after death, when it will be found that the same light is emitted as during life, and if rubbed against any rough surface a streak of light will be produced resembling that of burning phosphorus.

Whether this light is given to this animal for the purpose of pointing out its way in the dark, or for enabling it to find its companions in the night, or perhaps, by inspiring fear, to serve as a defensive weapon against its nocturnal enemies, can not be exactly determined. It is certain, however, that this light has often frightened ignorant people, who were wholly unacquainted with the objects of Nature, and who have actually taken these insects for ghostly spectres or the spirits of their departed friends. How many like absurdities would be banished from the common mind were the study of Natural History more popular and more universally pursued! Why will the young of this generation be content to look at Nature "as through a glass darkly," when properly directed study might remove the scales from their eyes, and enable them to see the light radiating from a thousand points hitherto enshrouded with the mists and shadows of ignorance and superstition!

The grubs of the Lightning Spring Beetle, like most of this family, are injurious to vegetation, living in sugar-cane and trees, and converting them into saw-dust. But not less destructive are the innumerable tribe of

Capricorn Beetles, or Long-horned Beetles (Cerambycinæ).

These Beetles are so called on account of their long feelers (antennæ), which resemble those of a mountain goat, and which, in some species, are longer than their body. They may also be recognized by their hard, horny skin, and by the four joints on each foot.

Their body is cylindrical; their head short, broad, and bent downward, provided with strong jaws, as also with long, bristle-shaped antennæ; their thorax is generally cylindrical, but, in some species, flat, and armed with thorns on both sides; it emits a sound which is effected by friction, that is, by moving it continually up and down, like a person rocking in a rocking-chair. On this account the Germans call them "fiddlers."

These Beetles, particularly those of the Southern States and of the tropics, are very handsome, and usually attract a good deal of attention by their elegant forms and fine colors. But their grubs are ugly, and none of them of a handsome color. They live always under the bark, or in the interior of the trunks of trees, where they dig serpentine passages, converting the wood into a mealy dust with which they stop up the entrance to their abode. Here they live, feeding continually on the green wood, for two or three years, until they are ready to metamorphose themselves into cocoons, from which they afterward issue as perfect Beetles.

The numerous species of Capricorn Beetles differ from one another in color, in the length of their antennæ, and also in respect to their size. The *Clytus pictus*, for instance (Fig. 13), is a North American species, and is only a few lines long, while the *Prionus Hayesii*, a Capricorn Beetle of Western Africa, is nearly five inches long and one inch broad. Its antennæ measure seven inches, and its legs are four inches long. This gigantic insect is of a dark brown color, and has many thorns upon the thorax.

The PAINTED CAPRICORN (*Chytus pictus*).—This beautiful insect is one of our autumnal visitors, and one of the countless host of evidences that the rolling year is full, only as every season brings its own peculiar charms. Spring is the time of youth, of buds, and of flowers; autumn the harvest of maturity, of blossoms, and of fruit. If the merry month of May adorns our woods and meadows with their youthful vegetation, their chirping birds and delicate flowers, so is the beginning of autumn none the less lavish in its golden harvest of grain, its melodious songsters, and its crown of brilliant flowers. There, from the red-leaved bushes, the tall Rudbeckia peeps out its golden head; here, the blue Vernonia and Liatris mingle with the yellow Helianthus and Coreopsis, forming showy figures upon the green velvet carpet of the field; while the purple and white Eupatoriums, blending with the rosy Spireas and crimson Cardinal flowers, and all bordered by the variegated Asters and perfumed Golden-rod, form one magic sheet of kaleidoscopic images!

Figure 13.



Painted Capricorn.

It is upon the slender Golden-rod, feasting upon the pollen of its flowers and upon its aromatic leaves, that we see the handsome little *Painted Capricorn Beetle*. This insect is little more than half an inch long, and of a cylindrical form. Its whole body is black, and looks like velvet. Its head and thorax are crossed with yellow lines, and its wing-covers are marked with lines, triangles, and spots of the same color. Its antennæ are half as long as its body, and its legs of a reddish brown color.

Although this Beetle is seen in the month of September feeding upon the flower-dust of the Golden-rod, its children have a different taste. Hence the female deposits her eggs in the crevices of the bark of locust-trees, and the grubs

issuing from them immediately bore holes into the trunks of these trees, making winding passages through them, and feeding exclusively on the wood and pith. These insects continue in the condition of grubs only about a year, they being metamorphosed into perfect Beetles in the following September; but while in this transition state they are very active, and the destruction of locust-trees by them is very considerable.

Dr. Harris, of Cambridge, in his Report on the Injurious Insects of Massachusetts, speaks of this Beetle particularly; and the late Thomas Say, in his American Entomology, Table 53, represents four new species, which he calls *Clytus speciosus*, *C. hamatus*, *C. undulatus*, and *C. caprea*.

We have now comparatively little to fear from the ravages of noxious insects, since our prudent Legislatures have enacted laws for the protection of birds, the great destroyers of insects, and it is probably on this account alone that many species of insects injurious to vegetation have almost entirely disappeared. In my travels through several States I have not, for the last two years, met with any of the Rose Bugs (*Macrodactylus subspinosus*), so destructive to every flower, nor with any of the Spotted Rutela (*Rutela punctata*), so injurious to the grape-vine. Even the May Beetles (*Melolontha quercicula*) are not seen in such abundance as in previous years, and, should the laws for the protection of birds be much more strenuous, I fear our poor entomologists will be entirely thrown out of employment. It is a matter of congratulation, however, that our favorite birds are so well protected by the laws of some of our States, and by the general consent of the people. They are more to be admired, even for their beauty, than most of our noxious insects, and certainly reward us by saving our trees and shrubs, and by furnishing us a wholesome and palatable article of food.

The CLOAK-BEARING CAPRICORN (*Desmocerus palliatus*)

is another Beetle of the same family. It is about one inch long, and of a changeable blue color, except the upper part of the wing-covers, which is of a pale orange color, and gives the animal the appearance of one carrying a cloak across his shoulders. Hence its name. Its antennæ are a little longer than half the length of its body. This insect may be found upon the common elder, and its grubs in the stems of the same shrub.

Figure 14.



Cloak-bearing Capricorn.

The largest Capricorn of the southern parts of North America is the Stag Beetle Capricorn (*Prionus cervicornis*), which is three inches and a half long, of a brown color, and has jaws like a Stag Beetle, one inch long.

But the handsomest of all is the Long-armed Capricorn (*Lamia longimana*) of South America. It measures two and a half inches in length, and one inch in breadth. Its fore-legs are five inches long. Its head, thorax, and wing-covers are dark olive-green, striped with red, yellow, and white in a very singular manner, and resembling hieroglyphics.

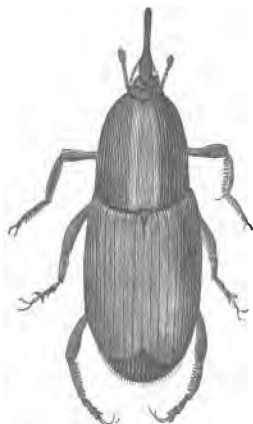
Snout Beetles (Curculiones).

The Snout Beetles occupy the lowest rank among Coleopterous Insects, partly on account of their head, which is prolonged into a bill-like pointed snout, with a very small mouth at the end, and two triangular antennæ, and partly on account of their larvæ, which are maggots, like those of flies, having no legs. The female of these insects bores holes with her pointed mouth in the vegetable body in which she deposits her eggs, and the maggots issuing from them enter the stems of annual and perennial plants, devouring all their internal substance, and destroying whole

plantations and forests. The ravages occasioned by these maggots are seen on our fruit trees, apples, pears, plums, chestnuts, hazel-nuts, and in the rice, peas, wheat, and other grains.

The PALM-WEEVIL (*Calandra palmarum*) is one of the

Figure 15.



Palm-weevil.

largest Snout Beetles of North America, but it is found mostly in the tropics. I found it in St. Domingo, and have given an illustration, or rather representation, of it in this work, because it gives an excellent idea of the form and appearance of all the other genera and species of Curculiones. This Beetle is about an inch long, and is black; it has large eyes, triangular antennæ terminating in a knob, and a long snout, upon which is a hairy crest like the mane of a horse; its wing-covers are striated. Its larvæ are known

in the tropics of America under the name of Palm-worms, and they live in large numbers in the trunks of several Palm-trees, but principally in the Cabbage-palm (*Areca oleracea*), which grows in abundance in the mountainous parts of St. Domingo. When fully grown, they are about three inches long and one inch in circumference, of a dirty yellow color, with a black head, looking like a piece of fat enveloped in a transparent skin. These disgusting-looking animals are roasted upon a wooden spit, or broiled, and eaten with dried and pulverized bread, seasoned with salt and pepper, and considered by many epicures as the *ne plus ultra* of delicacies.

It is a pity that the people of St. Domingo have not adopted the polite custom of the Austrians, who never sit

down to a meal without bowing profoundly to each other, and saying, "I wish you a good appetite!" This friendly and polite salutation would be peculiarly apropos before so delicate a dish.

The Cabbage Palm-tree has the same general appearance as the Cocoa-palm, but its fruits are not larger than peas. The inhabitants frequently cut down these trees, for the purpose of getting from its top the unexpanded terminal leaf-bud, which weighs many pounds, and is of a cylindrical form. This is called the Palm-cabbage, and is eaten in soups, or is boiled and prepared with vinegar and oil as a salad, and has really a delightful taste. Then they make incisions in the trunk, in order to entice the Snout Beetle there by the evaporation of the sap, and to have her deposit her eggs in it, that they may afterward obtain a large crop of maggots.

Another species of Snout Beetle is the WHEAT-WEEVIL (*Calandra granaria*), which is not larger than a flea, oblong, and chestnut-colored. These insects do immense injuries in granaries by boring a hole with their snout into the grains of wheat, or barley, or rye, and depositing therein an egg, from which proceeds a white maggot, which devours all the farinaceous substance, so that nothing remains but the hull. These maggots live in this condition about thirty days, when they metamorphose into white cocoons, from which, after about ten days, the perfect Insects proceed, the females of which immediately deposit their eggs, each laying about one hundred and fifty.

This Wheat-weevil is originally a native of Europe, and seems to have been accidentally imported here with grain.

The RICE-WEEVIL (*Calandra Oryzæ*) belongs to the same genus, and is found, as its name indicates, in rice, where it may be seen every day. It is of about the same size as the preceding, but differs from it by having two spots on each wing-cover.

In almost all the different seeds we find very small maggots, which are afterward metamorphosed into Coleopterous Insects, and are on that account called Seed Beetles. These animals, like the ones we have just described, have a prolonged snout, but comparatively much shorter, and a very short body.

The most destructive among them is the PEA-WEEVIL (*Bruchus Pisi*), famous in Europe, but much more common in America, the larvæ of which live in peas. The Beetle itself is about the size of a bed-bug; round, flat on the upper surface, of a dark-brown color, with white spots upon the thorax and wing-covers.

When the peas are in blossom and begin to have pods, the females deposit their eggs upon them, and we find, therefore, a very small maggot in almost every green pea, the existence of which can only be perceived by a small black dot upon it. In almost every seed-pea, also, we find a perfect Beetle, or at least an aperture from which it has already crawled out.

Now as this is a fact of the truth of which every one can convince himself, it is safe to assert that in eating green peas we at the same time eat almost the same number of maggots. If, therefore, we are disposed to be disgusted with the Palm-worm eaters, we would do well to remember that we practice the same thing in the case of the Pea-weevil.

In some parts of Europe they put their seed-peas into hot water before planting, for the purpose of killing these Beetles; and several of our scientific American Horticulturists, according to Dr. Harris, advise to keep seed-peas in air-tight vessels over one year before planting them, or at least not to plant them before the end of May.

The cultivation of peas is an extensive branch of agriculture in the Old Country, because dry peas, well prepared, are the usual favorite dish of the farming and oper-

ative classes throughout the year. Hence in France, Germany, Moravia, and Hungary they sow peas in gardens, and cultivate them in extensive fields.

Leaf Eaters (Chrysomelinæ).

The LEAF EATERS are another species of noxious Beetles, who feed mostly on leaves or flowers. They are quite small, from three to five lines long; their antennæ are fili-form and granulated, and their legs generally short. Their mouth does not terminate in a snout, like those we have before described; but it succeeds in destroying leaves and flowers in great numbers. Their body is oval, and beautifully colored, either crimson or blue, golden-green, azure-blue, or variegated. Their larvæ, or grubs, have six legs, and live mostly upon leaves, until they change into perfect Beetles.

This family contains a large number of genera, of which one of the handsomest is

The GILDED DANDY (*Eumolpus auratus*), which is found throughout the United States upon the Dogbane (*Apocynum androsaemifolium*), the leaves of which are covered with them in July and August. This Beetle is so brilliant that it is impossible to represent its splendid metallic colors in painting, changing as they do from green to a golden yellow, and from purple to crimson. Its wing-covers would form a beautiful ornament for those fancy-boxes I have before described, as its colors are pre-eminently brilliant and showy.



ORDER IL

BUGS—(*HEMIPTERA*).

As no human eye can ever penetrate the spangled heavens that roll over us, covered with ruby and sapphire, and the thousand changing tints that dye the firmament—as no created being can ever bring into his scope of vision that illimitable space, where the glittering stars unceasingly twinkle and glow, and where, o'erarching all, the Milky Way presents the blended light of billions of shining worlds—so no human mind can ever attain perfection in the knowledge of those countless animated beings which surround man in the vast green temple of Nature. The utmost expansion of the human intellect can comprehend only a small part of the wondrous nature, life, and character of the animated masses around him. The most gifted genius and the highest cultivation, combined with the longest experience, can only bring man to a knowledge of his ignorance and incompetence, and the burning thirst for more knowledge will only be satiated in adoring what it can not comprehend. True, “immortal longings are within us,” but mortal limits surround us on every side, and he who has approached even these the nearest will be abashed at the immensity still before him, and can only bow in humility before the great Creating Soul of the Universe, the all-wise, all-mighty, and all-loving Father—the same incomprehensible Being who has animated the mountainous bony frame of the Elephant, and built with wondrous skill and nicety the delicate structures of those little living, moving atoms we call Bugs! and not only has breathed into them the breath of life, but, more wonderful still, has provided them with

senses, with internal and external faculties, and constituted them equally essential parts in the vast economy of Nature.

Bugs are easily distinguished from other insects by having, instead of a mouth, a prolonged horny proboscis, or snout, in which are two pairs of bristles which they insert into the animal or vegetable body, from which they derive their nourishment by pumping out its juices. This proboscis is articulated to the head, and when in operation has a perpendicular, but when not in use, a horizontal position, being attached to the under part of the breast. Their head is usually small, and has two short feelers (*antennæ*); their breast larger than the head, and the hind body is short and wide. All the insects of this Order, the Bed-bugs and female Plant-lice excepted, have four wings, which are erected, as in the Cicada, known under the name of Locust, or folded up, as in the Squash-bug (*Coreus tristis*).

Bugs do not metamorphose themselves into Caterpillars, like Butterflies; or into grubs, like the May Beetles; or into maggots, like Bees and Flies. They make no cocoons or chrysalis, but they burst from their eggs in an almost perfect condition—that is to say, with six legs and a proboscis, but without wings. The Cicadas form the only exception to this natural rule, and probably live in a larva state more than two years in the ground.

These insects feed mostly on the juices of plants; but some of them pump out the circulating fluid of insects, and even the blood of warm-blooded animals, on account of which they become very annoying and troublesome to man. Some of this order also give out a peculiarly unpleasant odor when mashed, an odor that is often perceived in the mouth when eating raspberries, blackberries, or any other berries, and which is occasioned by masticating with the fruit the eggs which these insects have deposited upon it, and which are not easily detected by the sight. I once heard a country woman consoling her little boy, who com-

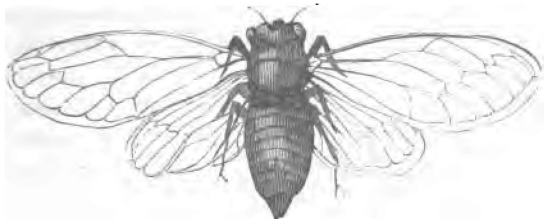
plained that the blackberries he was eating tasted so much like Bed-bugs, by telling him, "Never mind, sonny, keep on eating them—our doctor, the blacksmith, says they are good for fever."

Considered as a whole, the insects of this order are not as injurious as are Caterpillars and many grubs, but some of them are quite destructive, as, for instance, the Plant-lice, which absorb so much of the juices of vegetables as to cause their decay. The Cochineal is the only insect of this Order from which we derive great benefit, and that is of vast importance as a coloring substance. I say the only one—I ought, perhaps, to include the much-despised Bed-bug, for which I always had a great aversion until I accidentally learned its utility. Some few years ago I fell in with an industrious mechanic, who had a wife and four half-grown children, living in Avenue B, New York—all healthy, industrious, and in thriving circumstances. He told me that they all worked every day from three o'clock in the morning until eleven o'clock at night; and when I expressed my astonishment at their being able to work so hard with only four hours' sleep at night, he answered that they could not do otherwise, for they could not go to bed until from the want of sleep they were sufficiently benumbed to be insensible to the stings of the Bed-bugs, who after about four hours would overcome their insensibility and oblige them to leave their beds. Here behold the utility of Bed-bugs! they make industrious and wealthy. Perhaps the consumption of the midnight oil and the early rising of college students may also, in some measure, be attributed to the friendly hints of these interesting insects.

Cicadae.

The *Cicada*, improperly called Locust, contains a number of species. The RED-EYED CICADA (*Cicada septemdecim*), which in all entomological works, particularly in the Unit-

Figure 17.



Red-eyed Cicada.

ed States, is called the "Seventeen-years' Locust," makes its appearance every year, according to my observations when abroad; and during my twenty-seven years' residence in this country I have seen some of them every year, but myriads in 1829, 1834, 1843, and afterward.

Linnæus gave the specific name "*Septendecim*" to the Red-eyed American Cicada, because with the specimens of this insect sent him from America he was told that it appeared only every seventeen years—an opinion that still now extensively prevails throughout our country. But reasoning from analogy alone controverts this opinion; for if we consider that all other species of Cicadas, either of the same size, or larger, or smaller, subject to the same metamorphosis and manner of living, spend only two years in attaining their perfect condition, why should the Red-eyed Cicada alone form an exception to this natural law of their species?

But facts speak in an unanswerable tone in this matter. According to Dr. Hildreth's account of the *Cicada septendecim*, or Seventeen-years' Locust, in Professor Silliman's Journal, No. xviii., July, 1830, this insect appeared in 1829 in immense numbers in the States of Mississippi, Missouri, Illinois, Indiana, Ohio, Pennsylvania, and New Jersey. But the same quantity were observed five years after, in 1834, in the States of New York, New Jersey, Pennsylvania, Mary-

land, Virginia, Ohio, Indiana, etc. This insect also appeared again nine years after (1843), in innumerable swarms, in the Middle, Southern, and Western States; and at every appearance the newspapers say, "This is the year of the resurrection of the Seventeen-years' Locust, it being now seventeen years since it was last observed." The editors of the New York, Philadelphia, Baltimore, and Alexandria newspapers must, therefore, be very incorrect chronologists, or the years in those cities are much shorter than elsewhere.

Now it is a fact that during my twenty-seven years' residence in this country not a single summer has passed without my seeing some of these Red-eyed Cicadas in one or other of the States, and hence I must maintain that the name Seventeen-years' Locust is incorrect.*

* As our distinguished entomologist, Dr. Harris, disagrees with me with regard to the duration of life of the Red-eyed Cicada, I can not omit to quote his opinions on this subject, which he communicated to me in the subsequent letter:

"CAMBRIDGE, MASSACHUSETTS, January 10, 1855.

"*Professor B. Jaeger:*

"DEAR SIR,—On the evening of the 2d instant Professor Agassiz put into my hands, as coming from you, a copy of your work on North American Insects. I have carefully read it with much interest, and am particularly pleased with the anecdotes respecting the celebrated persons whom you have known. In your account of the *Cicada septemdecim* you maintain, contrary to the current belief in this country, that the term of life of this insect is not extended to seventeen years, but is limited to only about two years; stating that in the course of twenty-two years' residence in this country not a single summer has passed without your seeing some of them in one or other of the States. You are not singular in your opinion, such having been often expressed by gentlemen from Europe who have visited this country—as was the case, I believe, with Professor Agassiz, and certainly with some of the scientific gentlemen who accompanied him, but who have subsequently arrived at entirely different conclusions, and now acknowledge that the popular belief seems to be well founded. I beg you to understand that it is not now, and probably never has been maintained, that the Seventeen-years' Cicada appears at one and the same time, or in the same year, in *all* parts

That there is a great difference in their numbers in different years is very true, and the same thing obtains with regard to other insects; some years we are overloaded with them, and again in others there are scarcely any. This is particularly the case with the Rose-bug. The same thing also happens in the vegetable world—one year we are favored with an immense number of apples, peaches, grapes, etc., and the next year we see only a few of them. A superabundant number of other insects which feed upon the Cicada, changes of temperature, and unfavorable weather, are probably the causes of increase and decrease in different years. And in spite of so many opponents, who believe that the Red-eyed Cicada appears only every seventeen years, I, according to my own experience, am obliged to say, "For all this, it appears every year;" as Galileo, when he was compelled to undergo the sentence of public recantation for having taught the revolution of the earth, rose

of the country. On the contrary, it is well known that though 'locust year,' as it is improperly called, comes only once in seventeen years in the *same place*, it may occur in *other places* during various other years; so that it may well happen for a diligent traveler and observer in various parts of the country, during a succession of years, to meet with the same insects repeatedly in different years in different places. In the last edition of my Treatise on Insects injurious to Vegetation, I have given an enlarged list of the years and places in which this Cicada has been recorded to have appeared. From this you will find that its appearance at intervals of seventeen years in the same place has been repeatedly observed. Some of the most interesting facts in regard to this insect were communicated to me by the late Rev. E. S. Goodwin, recording their appearance in Sandwich, Massachusetts. The summer of 1855 is the time for their regular return at Sandwich, where they have not been seen for some sixteen years past, or since the year 1838, if I am rightly informed.

"Thanking you again most heartily for your kindness,

"I remain, my dear Sir,

"Very respectfully, your humble servant,

"THADDEUS WILLIAM HARRIS."

from his knees in saying "*E gira nemeno*"—Notwithstanding this, it revolves!

Another very general and very popular notion with regard to the Cicada is, that it is the same species, or at least the same genus, with that noxious insect mentioned in the Scriptures as one of the plagues of Egypt. This also is entirely incorrect.

Eleven different names of injurious insects occur in the Old Testament, called in the Hebrew *Arbe*, *Gob*, *Gobai*, *Gazam*, *Shagab*, *Chanamel*, *Chasil*, *Chargol*, *Jelek*, *Solam*, and *Pselatsal*.

Now in our English Bibles we find these words almost universally translated Locust, notwithstanding we have good reason to believe that almost all these insects mentioned are, according to their external and internal construction, very far from being of the same nature with our Cicada, but rather belong to the Grasshoppers (*Sauterelle*, *Heupferd*). In the book of Deuteronomy, 28th chapter, 38th verse, we read, "Thou shalt carry much seed out into the fields, and shalt gather but little in, for the Locust shall consume it;" and in verse 42d, "All thy trees and the fruit of thy land shall the Locust consume." Now we can not understand how it is possible that the Cicada, which with its proboscis sucks only the dew of leaves as its nourishment, and has no mouth with which it can masticate any thing, could occasion such immense ravages. But if we translate the Hebrew text, as Martin Luther did, with "*Heupferd*" or "*Heuschrecke*" in German, and with "*Sauterelle*" in French, which is "Grasshopper" in English, designating a very voracious insect, provided with two powerful jaws, and an animal very common in Africa, Asia, and the East of Europe, as well as in some of our Western States and Territories, we readily perceive how it is possible for such a creature to occasion famine and pestilence.

This error in the translation, originating from ignorance

of entomology, has often caused intense anxiety and alarm among the people of different parts of this country at the appearance of an innumerable swarm of Cicadas. They have actually imagined themselves afflicted with the Plague of Egypt, and apprehended famine and pestilence. To avoid this mistake, let us change the word "Locust," wherever it occurs in the Bible, into the word "Grasshopper"—an insect of which we shall presently speak at length, and in whose natural history will be found many additional reasons why it must be the insect designated in Scripture, and no other.

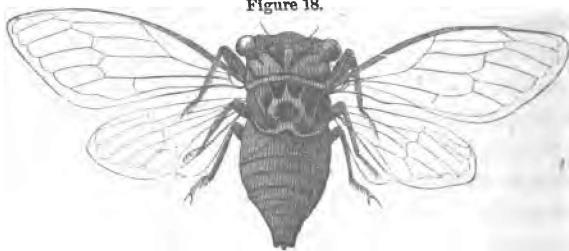
Our Cicada, commonly called Locust, is a harmless, lovely creature, and has been celebrated for its song from the most ancient times. "To the ancient Greeks no sound was more agreeable than the chirping of Cicadas, not only because it seemed to give life to the solitude of the shady grove and academic walks, but because it always conveyed to their minds the idea of a perfectly happy being." So delighted were they with its song that they kept it in cages and called it "the Nightingale of the Nymphs"—"the Sweet Prophet of the Summer"—"the Love of the Muses," etc. Indeed it was regarded by all as the happiest as well as the most innocent of animals. By both Greeks and Romans it was also considered as an excellent article of food, particularly the female before she had deposited her eggs; and Aristotle says of it, "*Quo tempore gustu suavissimæ sunt*"—At which time they taste very sweet.

The genus Cicada is found in all the temperate climates and warm countries of the globe. In the south and east of Europe they are continually singing, and continually an object of admiration. They dwell upon the olive and other trees, but principally upon the ash, from the bark of which, when pierced by their stings, there exudes a liquid substance, which becoming dry is known under the name of "manna," and which some have supposed to be identical

with that manna of which the Israelites did eat in the wilderness. This supposition, however, is probably incorrect, because the substance of which we speak is very cathartic, and is used as such even at the present day. But Ehrenberg discovered another species on Mount Sinai, produced upon the Tamarisk-tree by the stings of a Plant-louse (*Coccus manniparus*), which tastes like honey, and which may possibly be identical with that mentioned in the Bible.

The Red-eyed Cicada (*Cicada Septemdecim*, Fig. 17), with

Figure 18.



The Lyerman.

red-bordered wings, and the LYERMAN (*Cicada tibicen*, Fig. 18), with green-bordered wings, are the most conspicuous species of North America. But the natural history of all the different species is the same. All have an inflected snout, very short setaceous antennæ, four membranaceous wings, and six feet. The females have a long, horny ovipositor, and only the males possess the singing organ, which is an extended movable membrane on the under side of the abdomen, by the rapid vibration of which they produce their peculiarly loud and shrill sound. The females are all dumb. Virgil says :

“—raucis

Sole sub ardenti resonant arbusta Cicadis.”

Or, in English rhyme :

“While the scorching sun beats down upon the plain,
The bushes echo with the hoarse Cicada's strain.”

But Anacreon praises them, and in one of his odes compares them with the gods. William Spence, in his "Introduction to Entomology," thus translates the satirical words of the ancient Greek philosopher, Anaxagoras:

"Happy the Cicadas' lives,
Since they all have voiceless wives."

But a German writer, who was probably an old bachelor, in order to show that females of the human species are perhaps too much favored with regard to the organ of speech, says, in a very-sarcastic manner:

"Quando conveniunt Mariella, Sybilla, Camilla,
Sermonem faciunt et ab hoc, et ab hac, et ab illa."

According to the observations of several species of Cicadas made by Pontedera, Aldrovand, Reaumure, and many others, the females deposit many hundred eggs in the tender branches of trees, by slitting the bark with their horny, sharp-pointed ovipositor. Their eggs are white, flat, oval, and about the sixteenth of an inch in length. If the weather is favorable to them, the eggs are hatched in about six weeks, when the young ones leave the tree in the condition of larvæ, each one being provided with a mouth and six strong feet, resembling the flea. They then retreat into the ground, where they feed on roots, according to the observations of Pontedera, for two years, after which time they come out of the ground, climb upon a fence or the trunk of a tree, burst their transparent shell (Fig. 19), and assume their perfect form as four-winged insects. They now mount in the air, and enjoy their short life, flying from branch to branch and from tree to

Figure 19.



Grub of Cicada.

tree, making music as they go, and in the brief term of four or five weeks fulfill their last destiny, viz., to propagate their species.

“———Once a worm, a thing that crept
On the bare earth, then wrought a tomb and slept.
And such is man—soon from his cell of clay
To burst a seraph in the blaze of day.”

The Cicadas can not be classed among the injurious insects, for they can not devour our vegetables and fruits like other insects, because they have no mouth; and, as has been said before, they suck with their snouts only the dew of leaves for their nourishment, during the two short months of their existence in their perfect form. Even in their subterranean abode, during the condition of larvæ, although feeding upon the roots of several plants, their injury to vegetation is very trifling, and scarcely enough to indicate that the little creature dwells in the ground.

On the other hand, its utility is unquestioned—thousands of the feathered tribe find in them a delicious food; and Dr. Hildreth, of Marietta, Ohio, says, in his work already mentioned, that when the Cicadas first leave the earth they are plump and full of oily juices, so much so that they have been used in the manufacture of soap!!! It has also been reported that the Indians boil them and consider them a very palatable dish. “*De gustibus non est disputandum*”—Every one to his own taste.

The Cicada is one of the largest insects in this order, some of the exotic species measuring between six and seven inches in the expanse of their wings. Their legs, as has been seen, are most adapted for leaping, and their principal characteristic consists in the structure of that peculiar double apparatus, by which the males are enabled to execute their music. The peculiar construction of this apparatus has been carefully investigated by Reaumur, and made known in his “Memoirs.”

Mr. Westwood, in his "Introduction to the Modern Classification of Insects," says, that of one hundred and fifty species of Cicada contained in the Royal Museum at Berlin, seventy are from America, fifty from Africa, twenty-five from Asia, including Java, ten from the south of Europe, and six or eight from New Holland; showing that it is chiefly in the tropical parts of the world that the largest and greatest number of species are found.

The Indians of South America say and believe that the Lyerman (*Cicada tibicen*) is changed into the Lantern-fly (*Fulgora laternaria*), whose cap, in the night, emits a light similar to that of a lantern.

I have several times spoken of the impostures to which those are subjected who are ignorant of Natural History. There have been people who considered themselves well educated, that have actually believed and circulated such absurd fables as, e. g., that there are whole races of men with tails like those of the monkey tribe, of Hottentot women with natural aprons, of American Indians without a beard, and of Sirens, Mermaids, and the like. In the Natural History of Insects, too, marvelous stories are introduced by travelers in foreign countries, who have implicitly relied upon the reports of the ignorant natives, and whose stories, however absurd, have gained credence. This is the case with regard to the Lantern-fly, which is a native of South America, but which from its bodily construction belongs to the order we are now describing. This insect is provided with a comparatively large bladder, which is placed before its head, and from which, it is said, comes a strong light, as bright as that of a candle. This lightning story originated more than a century and a half ago, from the work of the celebrated Madame Merian, who lived several years in Surinam, and who says that one day the Indians brought her a large number of living Lantern-flies, which she put into a box, but they made so much noise

during the night that she rose from her bed and opened the box, which however she immediately dropped on the ground, so frightened was she at the multitude of fiery flames issuing from it.

Now modern naturalists, such as Prince Max of Neuwied, Prince Paul of Würtemberg, Count Hoffmannsegg, Mr. Lacordaire, and several others who have traveled in those countries, and have collected a number of them alive, state that none of the specimens they have ever seen alive exhibited the least appearance or trace of luminosity. And indeed of what use could such a lantern be, placed directly before the eyes of the insect? If we were obliged to carry a torch-light upon our foreheads directly in front of our eyes, we should be so dazzled that we could see nothing. This insect is three inches long, its head being of itself only a few lines in length, but, with the lantern, as long as its abdomen. It still retains its name of Lantern-fly, but its supposed light has long since been considered by naturalists as an ignorant superstition, or, at best, as a fact unsubstantiated by any of the species existing at the present day.

With regard to the marvelous interpolations in Natural Science, I can not forbear quoting from the work of the late Thomas Say the following examples: "We are told that there was a time when a piece of wood was transformed into a serpent; and even in the present age of knowledge, a hair fallen from the mane or tail of a horse into a stream of water is believed by many to become animated into a distinct being; dead leaves shed by the parent tree are said to change gradually into animals of singular shape, and to have changed their place of abode under the eye of the historian who related the wonderful tale; dead sticks were also said to sprout legs, to move from place to place, and perform all the functions of a living body. These, and a thousand other equally ridiculous stories, were, at one period or another, more or less generally admitted as indis-

putable truths, and to contradict them would only be to expose one's self to the imputation of ignorance or criminal faithlessness. And although at present the possibility of making a living serpent out of wood, and the story of animated leaves and sticks would be despised as absurd, yet many are to be found, both in Europe and America, who firmly believe in the animation of a horse-hair. But the most obvious errors have often a shadow of truth whereon to rest, or palliate, if not excuse them by the plea of ignorance or mistake. The historian of the walking-leaf may have been deceived by the *Mantis siccifolium* of Linnæus (the Soothsayer), the wings of which bear some resemblance to a leaf. The Gordius (a worm) resembles a horse-hair, and no doubt gave rise to the story of the metamorphosis above mentioned; and the account of the walking-sticks may have very honestly originated from the singular appearance and form of the insect which bears this name."

I have above mentioned the name of Madame Merian as originally circulating the story of the Lantern-fly, and as her name is somewhat celebrated in the annals of Natural History, a more extended mention may not be unacceptable to my readers.

Madame Maria Sibilla Merian was the daughter of Mathew Merian, a distinguished French artist. She was born in 1647, at Frankfort-on-the-Main, and early in life devoted herself to drawing and painting, particularly plants and insects. At the age of eighteen she was married to a painter of Nuremberg, named John Andrew Graf. This marriage did not prove a fortunate one; and a few years after it took place Graf's affairs became so much involved, and his conduct in other respects so censurable, that he was obliged for a time to leave the country. In consequence of this separation, Madame Merian never assumed her husband's name in any of her publications, but became known to the public by her maiden appellation.

After her separation from her husband she for a long time abandoned all kinds of company, and devoted herself exclusively to the painting of insects, in order to be able to represent them with sufficient accuracy for the purposes of Natural History. The result of her labors in this department appeared in 1679, in three volumes, published at Nuremberg, the plates being engraved by herself.

The difficulty of preserving Caterpillars and other larvæ is sufficient to account for the small number to be found in cabinets, even at the present day; and the most obvious and satisfactory method of making up this deficiency is by colored drawings taken from living specimens. The desire of supplying this important desideratum, in regard to some of the more remarkable insects of America, as well as of determining the nature of their metamorphosis and kind of food, had more influence in leading Madame Merian to visit this country than her wish to delineate the perfect insects, many of which were already known in Europe from the preserved specimens.

She accordingly set sail for America in the year 1699, accompanied by one of her daughters. The place of her destination was Dutch Guiana, often called Surinam, from a river of that name, on which the capital, Paramaribo, is situated, and lying between the fourth and sixth degrees of north latitude. In this fruitful region her ardent curiosity found ample means of gratification, and she remained nearly two years diligently employed in collecting and painting insects. She returned to Europe, and gave those splendid paintings to the public in 1705, in a work entitled "*Metamorphosis Insectorum Surinamensis*, etc., the text drawn up by Gaspar Commelin, from the manuscripts of the author."

This heroic and industrious female naturalist, who has contributed so much to the improvement and embellishment of the Natural History of Insects, died in the year 1717, at the advanced age of seventy years.

The Louse (Pediculus).

Among the Hemipterous Insects, which are distinguished from the other orders by their suctorial organs, as well as by the fact that they do not undergo a perfect metamorphosis, the Bugs, properly so called, form a very considerable number of different species, some of which, particularly those of the tropics, are ornamented with the most beautiful colors. They live upon animated beings, both on land and in the water; also in forests, gardens, and meadows; and are, according to their food, either carnivorous or herbivorous.

I trust I shall be pardoned for introducing to the notice of my readers a very disgusting Insect, which seems to have been created for the purpose of punishing inattention to personal cleanliness.

Certain parasites whose destiny it is to dwell upon the human body, and which we call lice, have been placed by Linnæus and his followers among the wingless (*apterous*) insects; but if we consider that they, like the Hemipterous Insects, are provided with a suctorial organ, also with air-holes for breathing, and do not undergo a perfect metamorphosis, we are forced to place them, like the wingless bed-bugs, in this order. The other parasites, which live upon beasts, birds, fishes, and insects, and which are also called by the people lice, belong to different other orders.

Many years ago, when people paid very little attention to personal cleanliness, it was generally believed to be a sign of good health to be infected with lice, by whom it was thought the impure juices of the body were extracted. Parents were, on that account, glad to see the heads of their children covered with sores, which were thickly populated with this vermin. But when they became better instructed, and began to keep their children clean, these insects ceased to be fashionable. For this purpose it is probable

that hair-powder, pomatum, and hair-oil were chiefly invented, and generally used, because every kind of grease destroys these insects, by stopping up their air-holes or breathing organs, and they immediately fall into convulsions and die—an experiment that may be repeated at pleasure on caterpillars.

These disgusting creatures make their abode principally upon the heads of human beings, as may be seen, for instance, in the haunts of the filthy poor every where, or the poor, oppressed Jews and peasants of Poland, or the down-trodden and degraded countrymen of Italy, and the innumerable host of beggars with which all her churches swarm.

According to the observations made in the year 1687 by the celebrated Dutch philosopher, Leuwenhoeck, the female Louse, in the course of six days, lays fifty white eggs, which are called Nits, and from which, after six days more, proceed the young ones, which are perfected in eighteen days. In this manner such a female may have the satisfaction of being grandmother to a progeny of five thousand individuals around her in the short space of eight weeks. This species is called the HEAD-LOUSE (*Pediculus capitis*).

Another species, also a nuisance to the human family, is the BODY-LOUSE (*Pediculus vestimentorum*), whose favorite dwelling is in the folds of the shirt-collar, and which probably produces that generally incurable disease called phthisiasis. It is humbling to human pride and the high conceit of mortal man to think that the poor and the rich, the ignorant and the wise, princes, kings, and emperors, have been and are alike subject to this misfortune. Examples are not wanting: the Dictator Sylla, the two Herods of Judea, the Roman Emperor Maximian, and the mighty Philip II., King of Spain, and many others, have been carried off by this disgusting, incurable malady, in which the whole human body becomes covered with sores, and is lit-

erally eaten up alive by these insects. See "*Maladies de la Peau, par Alibert, 1806.*"

The Bed-bug (Cimex lectularius).

Bed-bugs are, unfortunately, every where well known. They are found throughout the world, from the seventieth degree north latitude to the seventieth degree of south latitude, in both hemispheres, and inhabit principally the houses of populous cities. The walls of hen-houses are also sometimes entirely covered with them, and, what is very singular, the fowls themselves are never attacked by them; but as they people rapidly in warm fowl-manure, it is conjectured that they feed on them. Hen-houses near a dwelling-house are on this account dangerous.

That Bed-bugs suck the blood of man is very well known, but it is not so certain that blood is their only nourishment. I found them in abundance in the pine woods of Finland, near Wiborg, in Europe, as well as in the pine woods of North America, and in newly-constructed frame houses. It is probable, therefore, that they feed on the sap of pine wood.

In England it is believed that this vermin is a native of North America, and was accidentally brought over to Europe in the pine timber. But this can hardly be the case, as Aristotle, who lived three hundred years before Christ, mentions this insect in his "*Historia Animalium*," and so does Pliny, some centuries later, in his Natural History. They are undoubtedly natives of a warm country, for they like a high temperature, and are benumbed in winter, although experiments have been made in which an exposure to a temperature of five degrees below 0 of Fahrenheit did them no harm. Like reptiles, they can also live many years without food, as the German naturalist Goeze has proved, who kept them alive six years without any nourishment.

Kotzebue, then colonel in the general staff of the Russo-Caucasian Army in Tiflis, assured me, when I was there (1825), that he has seen several persons, when traveling in Persia, victims of the venomous bite of the Persian Bug.

This insect, though it is neither a native of North America, nor does it belong to the Hemipterous Order, is too notorious to pass over in silence.

The PERSIAN BUG (*Agras Persicus*) is similar to a Bed-bug in color and form, but a little larger, and provided with jaws. It has long been known as the venomous bug of Miana in Persia, which city lies south from Tauris. That same Mr. Kotzebue, the son of the celebrated unfortunate German poet, August Kotzebue, Russian Counselor of State, who was assassinated 1818, in Manheim, by the student Sand, went as attaché to the Russian Embassy of General Yermoloff to Teheran, and published afterward in Germany his "Travels through Persia," in which he says: "The city of Miana, with the surrounding country, is renowned on account of its venomous bugs. They live in the walls of old buildings, and the older the masonry the more abundant and venomous they are. Several villages are entirely deserted, because their inhabitants have been driven out by those venomous bugs."

Those bitten by them become crazy, mad, and die with terrible convulsions.

With regard to the general protection of animals in some parts of Hindostan, we find a very curious article in "Forbes's Oriental Memoirs," who says: "The Banian hospital at Surat is a most remarkable institution. At my visit the hospital contained horses, mules, oxen, sheep, goats, monkeys, poultry, pigeons, and a variety of birds. The most extraordinary ward was that appropriated to rats and mice, bugs, and other noxious vermin. The overseers of the hospital frequently hire beggars from the streets, for a stipulated sum, to pass a night among the fleas, lice, and bugs, on

the express condition of suffering them to enjoy their feast without molestation."

O stulta sanctitas, O sancta stultitia!

The Squash-bug (Coreus tristis).

This insect, which conceals itself during the winter in the crevices of houses, walls, and the bark of trees, makes its appearance in the open air as soon as warm weather commences, and takes up its abode, for the most part, upon or under the leaves of squashes, pumpkins, and other plants of the Gourd tribe. It is also often seen upon the potato vine and other herbaceous plants, and toward the middle of summer it fastens its



The Squash-bug.

eggs, with a gummy substance, upon the under sides of the leaves of these plants. These eggs are soon hatched, and the young, in company with the old ones, proceed to suck with their reflected snout the sap of those leaves and stems, often causing the whole vine to wither and perish.

The young ones, which are quite as voracious as their parents, are furnished with wings in the autumn, and as soon as the inclemency of the weather and the want of food obliges them to do so, they fly away to take possession of their winter-quarters, in the holes of walls, or the crevices of houses and the bark of trees.

These insects emit an odor, when touched or mashed, very similar to that of the Bed-bug, and the wound they inflict with their horny snout is fully as inflamed and painful.

There is no better remedy to prevent the injuries done by these insects than to examine the squash and pumpkin vines every day and destroy them; for, to use the argument adduced in favor of capital punishment, if they are

killed they are forever out of the way. I would suggest that for boys in the country this would afford a fit and amusing occupation when out of school, thereby keeping themselves and the bugs from doing mischief.

This species of bugs, as well as all kindred ones, inflict often painful wounds, which are sometimes more venomous than the sting of a scorpion, which is often experienced in tropical countries, and produce tumors as big as the egg of a pigeon, for several days. But it is much more singular that there is found in the West Indies a bug known by the name of the Wheel-bug (*Reduvius serratus*), which, like the Electric Eel and the Torpedo, communicates to the person whose flesh it touches an electric shock, which comes out from its legs.

Tree-hoppers (Membracis).

Figure 21.



The Tree-hopper.

The TREE-HOPPERS are mostly of a green color, and small size; they have four wings, and a very large thorax or chest; they possess the power of leaping a distance of five or six feet, which is about two hundred and fifty times their length. They generally remain motionless for hours upon the leaf of a bush or tree, imbibing the sap of the plant; but at the approach of any one they suddenly leap with great ease into the air, at the same time spreading out their wings, and fly to some other abode.

They feed mostly on the leaves of the oak, the locust, and several other trees. But their injury is of no great importance. The principal species of Tree-hoppers are the

Membracis Ampelopsidis, on the *Ampelopsis* vine;

“ *bimaculata*, “ locust-tree;

“ *univittata*, “ oak-tree, etc.

Plant-lice (Aphis).

Like the preceding insects, the Plant-lice belong to the order of Bugs which constitute the Hemipterous Insects. They have small round bodies, of a brown, black, yellow, or blue color. Some species are provided with wings, some others have none; but on the back of all of them may be seen two honey-tubes, or honey-warts, from which issues a sweet substance very much liked by the Ants. For this reason we find even such carnivorous insects as the Ants on friendly and intimate terms with the Plant-lice. In fact, they are called the milk-cows of the Ants, because the latter suck from them the sweet juice of their honey-tubes. They are as careful of them as we of our cows, protect them from their enemies, and, in case of danger, even carry them away in their mouth very carefully to a safe place. This sweet fluid of the Plant-lice is also often seen upon the branches of trees or shrubs—a glutinous substance known by the name of honey-dew, and eagerly sought by Ants. If, therefore, we see Ants running up and down the branches of trees and shrubs, we may consider it a certain indication of the presence of Plant-lice.

There is scarcely a tree, or bush, or herb that grows in our gardens or fields that is not infested with some species of Plant-lice; and in spite of their diminutive size, and the disgust we naturally have for them, a host of interesting associations are connected with them. Their manner of living, and of reproduction also, have attracted much interest. They both deposit their eggs and bring forth their young alive—a phenomenon which does not take place in any of the four-winged insects. Their multiplication is immense, and, considering the size of the animal, really astonishing; for it is a well-known fact that one single Plant-louse is capable of producing ninety young ones, from which spring myriads more. From the month of April to No-

vember nearly twenty generations are born; and if their number were not checked by their numerous enemies, as well as by wet, damp weather and cold winters, all of our vegetable productions would not suffice to nourish them.

The principal species of this country, which may be seen and examined every where, are:

The ROSE-LOUSE (*Aphis roseæ*), which is green.

The PIG-NUT LOUSE (*Aphis caryæ*), which is the largest, viz., one quarter of an inch long, and covered with a bluish woolly substance.

The CABBAGE-LOUSE (*Aphis brassicæ*), covered with a white mealy substance.

The WILLOW-LOUSE (*Aphis salicis*), which is black.

Shield-lice (Coccus).

The SHIELD-LOUSE, also called Bark-louse, or Scale Insect, is found upon the branches and leaves of trees and bushes, upon which it sits motionless, as if it were glued on, looking more like a wart than a living creature. This, however, is the case only with the female, who inserts her snout into the branch upon which she sits, and remains there imbibing the sap of the plant. In this condition also she deposits her eggs, and after having done so she dies upon the same spot, leaving her dead and dried body a cover and shelter to her young ones. The males have no snout, and walk about the branches at their pleasure.

The body of the Shield-louse is oval, and the head, thorax, and abdomen run into one another so imperceptibly, that the whole appearance of the animal is like that of a shield or buckler. Hence its name.

I have before remarked, and I may often have occasion to repeat the remark, that to the lover of Nature nothing, even the most vile and insignificant object that lives, is without some points of interest—each has something curious in its construction or mode of life, or manner of repro-

duction, or in its uses—ay, and more so in the injuries it is capable of doing! It sometimes seems as if the meanest and most trivial of earth's creatures were created for the express purpose of working out the vastest amount of evil! as if there was nothing else to distinguish them or make them deserving of notice! And when Godlike Man, the highest link in the animal creation, the last step between the creature and the Creator, when such as he attempts to procure renown by the vast amount of injury he can inflict; when, undistinguished from his fellows save by the halo of destruction that surrounds him, he mounts the throne of human glory by "making countless millions mourn"—and not a few have clothed themselves with such unenviable immortality!—why should it not be so with the meanest insects? Independent of its curious construction, why should not the subtle manner in which it works a vast amount of injury prevent even the vile Shield-louse from being passed by unnoticed among those of its order? Let the vain man who would imitate it think of the base level to which he must stoop, and from this insignificant animal learn one of the lessons Nature is every where teaching!

Probably hundreds have passed through their orchards, day after day, without noticing this insect, although myriads have been in sight. Many well-educated farmers have seen their peach-trees covered with brownish warts, and have suffered them to wither and die, without dreaming that these warts were live animals, sucking the sap, the life-blood of the tree; and yet these motionless excrescences have laid waste whole orchards, have devastated the fairest of bushes and the most fruitful of trees, and in place of fragrance and verdure have left naught but desolation and decay. They are essentially noxious insects, which, if unmolested, multiply immensely, and hence should be carefully sought upon the branches of our trees, and, as often as they make their appearance, destroyed at the point of the knife.

Their color very nearly resembles that of the branches upon which they alight, usually a brown or black, but sometimes a reddish or violet; and hence they scarcely ever attract attention unless looked for. The branches of peach-trees are their particular resort, and may often be seen covered with them, making the branches look rough and knotty, and the leaves and fruit dirty and black from the rain washing upon them from the bodies of these filthy Shield-lice.

The Cochineal (Coccus cacti).

My readers, I presume, will find it an agreeable transition to pass from an insect whose only distinguishing quality seems to be its noxiousness, to one justly celebrated for its utility—to one abounding in interest and curiosity,—to one to which they are indebted for the most beautiful of the colors which adorn their persons and “beautify the human form divine.”

It is a wonderful thing to look abroad over the face of Nature, and see how every mineral, vegetable, and animal production is constituted so as to minister in some way to the wants of man—to see the vegetable world silently engaged in extracting mineral matters from the soil, and storing them up for man, and man, impelled by instinct, selecting these as his own proper food—to behold not only his food and drink flowing constantly to him through the ever-revolving cycle of three kingdoms, but even his most valued ornaments presented through the same natural channel! It is more than wonderful, it is sublime, to view atom after atom of the whole creation unceasingly changing place, that man, the lord of creation, may be abundantly supplied with all his comforts and his luxuries; to see the lilies of the field, and the insects of the earth and air, living and dying for man, yielding up their lives for man’s sustenance and adornment. True, “the lilies of the field take no thought for the morrow,” but the unseen finger that

opens their petals to the day points them out as the appropriate food to some of those animals whose life or death ministers to man! The blooming Cactus not only charms the eye of man, and makes the arid desert blossom as the rose, but it furnishes food for an insect that lives upon it, and grows and dies to clothe man with the same resplendent dye.

This insect is the Cochineal, a species of Shield-louse, also called Scale Insect, of the genus *Coccus*, and of the order *Hemiptera*.

This little insect has a curious history. It was used for dyeing the most brilliant and beautiful red and purple colors, and was considered a valuable article of commerce, from which much money was made, long before it was known what the substance was composed of.

The French Naturalist, Plumier, in 1692 excited the ridicule of his nation, and was considered a fool because he pronounced the Cochineal to be an insect. But in 1714 the French Philosopher, Geoffroy, proved the opinion of Plumier to be correct. By moistening these supposed seeds in vinegar Geoffroy was able to detect the ringlets of its body as well as its feet, and accordingly pronounced unhesitatingly the Cochineal to be an insect. Ruusscher, in Holland, held the same opinion, and was publicly assailed for it, on account of which he caused the Cochineal cultivators to be summoned before the court of Antiguera, in the valley of Oaxaca, in Mexico, there to be examined with regard to the origin and nature of these creatures. The examination proved Ruusscher's opinion correct, and the Cochineal henceforth was considered an insect. This was probably the first instance in which an animal was restored to its natural rights by the decision of a Judicial Court.*

The Cochineal is a natural production of North and

* See Naturlyke Historie von de Cochenille. Amsterdam, 1729.

Central America, and is found principally in Texas, Mexico, and Lower California. It looks like irregular grains, scarcely as large as a pea, which are convex on one side and concave on the other, and of a reddish, slatish-white color. As has been mentioned, it is a species of Shield-louse, but was always supposed to be a grain growing upon the plants upon which it is found. It is principally found upon the Prickly-pear (*Cactus cochenilifer*) and other species of Cactus.

There are two sorts of Cochineal which are used in commerce; viz., the domestic, which is cultivated upon the Prickly-pear, planted in large quantities expressly as food for this insect, and the wild, which is obtained from the spontaneously-growing Cactus.

Mexico and Central America are the only countries in which the Cochineal are raised expressly for commerce, and this principally in the provinces of Tlascala, Oaxaca, Guatemala, and Honduras, from which places alone, according to the account of Humboldt, there are every year exports of this article amounting to two and a half millions of dollars. An enormous sum, indeed, to be annually expended for insect cadavers.

There are, for this branch of industry alone, plantations containing more than fifty thousand Cactus plants, cultivated for no other purpose than to serve as food for these valuable little insects. The collection and preparation of this article of commerce most generally falls to the lot of the Indian woman.

It is a remarkable circumstance that the dried Cochineal never perishes, and may be kept in store-houses perfectly preserved for hundreds of years—a fact which clearly indicates the use which Nature intended should be made of it.

The best treatise on the Cochineal, and one which contains every thing that is known or can be said of it, is that

written by Thiery de Menonville: "Traité de la culture du Nopal, et de l'éducation de la Cochenille. Paris, 1787:" to which I refer the reader.

The Cochineal insect is often found in our hot-houses on the Prickly-pear and other species of Cactus, and it might easily be raised in many parts of our country for amusement or experiment; but, owing to the high price of manual labor, we could not at present, and probably never, compete with Mexico in cultivating it as an article of commerce.

The Spaniards have imported this insect into Spain, and the French into Algiers; but with what success they will cultivate it is as yet problematical, as the former are not sufficiently encouraged by their rulers, and the latter prefer the sight and sound of swords, guns, and bayonets to the more pleasant and profitable pursuits of Agriculture.

Another species of Shield-louse, although not a native of North America, deserves a passing notice on account of its great utility in the production of a most important material for manufacture and commerce. This is the *Coccus LACCA*, a native of Hindostan. This Scale Insect is found upon the branches of Banyan-trees (*Ficus religiosa*), and several other trees and shrubs, where it secretes from its body a hard, gummy substance, adhering to the branches like a crust, and well known in commerce by the name of shellac. This substance is a most invaluable material in the manufacture of varnishes, sealing-wax, beads, arm-bracelets, necklaces, water-proof hats, etc., and is extensively used in dyeing. Mixed with very fine sand it forms grindstones, and added to lamp or ivory black, being first dissolved in water and a little borax, it composes an ink of a very good quality, and, when dried, not easily acted upon by dampness or moisture. Notwithstanding the vast amount of this substance that is constantly consumed in manufactures of various kinds throughout the world, still this little insect pro-

duces it so fast and so abundantly, that, were the consumption of shellac ten times greater than it is, it could readily be supplied.

There are many other species of Shield-lice found in the old countries, which have from time immemorial furnished a substance used for dyeing red, and which are still used for that purpose. Hence their name among the Greeks and Romans was "Coccus," by the Arabs called "Kermes," and by the Persians "Alkermes."

Professor Ehrenberg, of Berlin, to whom the science is so much indebted for his laborious microscopic investigations of the Animalcules, found large Tamarisk-trees (*Tamarix mannifera*, Ehrenb.) upon Mount Sinai, the young shoots of which were covered with a species of Shield-louse, which he called *Coccus manniferus*.

These insects, by puncturing the branches with their proboscis, cause them to discharge a large quantity of gummy secretion, which very soon hardens and drops from the tree, when it is easily collected by the natives, who believe it to be the real manna of the Israelites.

Our currant bushes, young apple, and peach trees, often suffer from the ravages of different species of bark-lice, and not unfrequently are destroyed by them. Many small birds feed principally on these species of Lice, but, in spite of this, their multiplication is often so great that we must rely upon other and artificial means to destroy them.

Dr. Harris, of Cambridge, mentioning them in his "Report on the Insects of Massachusetts Injurious to Vegetation," says: "The best application for the destruction of the Lice is a wash made of two parts of soft soap and eight of water, with which is to be mixed lime enough to bring it to the consistence of thick whitewash. This is to be put upon the trunks and limbs of the trees with a brush, and as high as practicable, so as to cover the whole surface, and fill all the cracks in the bark. The proper time for

washing over the trees is in the early part of June, when the insects are young and tender."

This may appear to my enthusiastic young friends like advocating wholesale murder, and they may deem me to have lost that universal benevolence and love which the study of Natural History usually inspires, when I recommend the massacre of many millions of little insects, whose only crime is that they eat the food that Nature has instinctively prescribed for them. It is true, all that is positively injurious ought not necessarily to be destroyed, still it is right that of two evils we should choose the least. A distinguished modern reformer of Germany has recently published a pamphlet, entitled "Murder and Liberty," in which he maintains the legality and moral right of assassinating all sovereigns and despots wherever they are to be found in the world. He premises his argument upon the fact that it has been, and is considered legal and right for all crowned heads to arraign and execute every patriot and political reformer, whenever and wherever he may be found: *ergo*, he argues, the same legality and right belongs to the patriot and political reformer to kill all crowned and uncrowned despots, whenever and wherever they may be caught.

Now, if such a doctrine finds adherents, I am sure I need not fear to recommend the massacre of all injurious insects, and upon the same principles of logic; they kill trees and shrubs, *ergo*, we should kill them.

The few insects here mentioned constitute but a small part of the numerous order *Hemiptera*, which, together with the preceding, are generally known under the common name of Bug, and, like those, are usually treated as objects of disgust or of fear. They are real natural bugbears to those unacquainted with their character or history.

The general deficiency in the knowledge of Natural History is, however, the greatest bugbear to me, and I can not

but lament, seeing it in so many otherwise well-educated men and women, in the editors of some of our distinguished journals, and in most of the travelers who are constantly publishing accounts of their journeys in foreign lands. How much more rich, amusing, interesting, and instructive would these reports be if their writers could adorn their topographical descriptions and special histories of foreign lands with information concerning some curious beasts, birds, reptiles, fish, insects, or plants, which they have accidentally met in their journeys.

Now the deplorable ignorance that so universally prevails with regard to Natural History arises not from any deficiency of genius in the American people, but it arises from the fact that our Schools, Colleges, and so-called Universities, which are the leaders and guides of general education, almost entirely neglect this department of Science. Hardly any of our Institutions of Learning, except Cambridge, have regular Professors of this branch, and except Princeton, in New Jersey, very few, if any, have Cabinets of Natural History, and none have a sufficient number of books treating upon this subject to form a library.

I have no intention or disposition to ridicule what is really a proper object of lamentation; but to one accustomed to the magnificent and extensive Cabinets of Natural History, which are always considered an indispensable part of the Universities of Europe, the Cabinets or Museums of our Colleges, containing a few pebbles, the skin of a rattlesnake, the broken shoulder-bone of a mastadon, and such like articles, can hardly fail of exciting a smile, even though it be accompanied with a tear of pity.

Some few years ago the President of one of our Western Colleges showed me their Museum, which contained many such wonderful articles as I have mentioned, and besides these precious specimens, a pair of black satin breeches, suspended by the waist and with the legs extended, like

those we see hanging in front of every tailor's shop, and near by, also suspended on the wall, an old German tobacco-pipe made of wood, and having a very long stem. When I expressed some surprise that such paraphernalia constituted a part of their College Cabinet, the President replied, "These breeches are the same identical ones which General M——, to whose widow I introduced you last evening, wore when he was introduced to the royal family in London; and the tobacco-pipe is the one I once used myself, but which, at the solicitation of my wife, I gave up forever, although I had previously been an inveterate smoker. These things exercise a great moral influence over the students, who can see by the first what a man can become, and by the second what he can do if he only has a firm resolution."

A very erroneous idea prevails with the managers of our Colleges in regard to the expense of establishing a Cabinet of Natural History. A splendid Cabinet may be collected at very little expense to any institution, if they only have a competent Professor in this department. Enthusiasm in any thing, but particularly in matters of Science, is very contagious, and the students who attend the lectures of a popular Professor of Natural History will very soon become themselves enthusiasts in this interesting department, and in all their excursions in vacation, or in the leisure hours of each day, will constantly be collecting zoological, botanical, or mineralogical specimens of all kinds, and in great abundance, for the Cabinet of their Alma Mater. The very desire to know what each insect, plant, or stone is, and what its use and scientific name, will prompt them to collect every thing with which they meet, and bring it to their Professor. In this manner a great number of duplicates will be obtained in a very short time, and these may be sent in exchange for other specimens, by the directing Professor, to his correspondents of this and of foreign

countries. If the College be situated near or in a sea-port, as is the case with the Institutions of New York, Philadelphia, Baltimore, Providence, Boston, and many others, a great supply of the most curious and interesting articles may be obtained by the sea-captains of such places, who, if solicited, will always be pleased and proud to collect specimens from all quarters of the world, with which to embellish the College of their native city.

No place in this Union has so great facilities for executing such a plan as the gigantic city of New York, and I hope soon to see her Institutions setting an example in this respect which will be worthy of imitation. The Legislature of the State of New York, several years ago, expended nearly half a million of dollars for the purpose of making its inhabitants acquainted with the natural productions of the State. A costly zoological, botanical, and mineralogical survey was made, and illustrated by the publication of a precious work containing several volumes, with numerous expensive engravings, and a Museum of the specimens collected was erected in Albany, for the inspection and instruction of the people. Each College may accomplish the same, at vastly less expense, in the manner above described; and our horticulture, agriculture, pisciculture, and mining operations, as well as our extensive commerce at the present day, demand more attention to this important branch of science.

ORDER III

STRAIGHT-WINGED INSECTS—(*ORTHOPTERA*).

ALL insects which have transversely movable jaws, membranous wings (a few have no wings), six legs, and undergo no metamorphosis, belong to the Order *Orthoptera*, which signifies in English "Straight-winged." Among these are Grasshoppers, Walking-leaves, Crickets, Cockroaches, Earwigs, Soothsayers, Walking-sticks, etc.

Grasshoppers.

Grasshoppers have been divided by Linnæus into two families; viz., *Grillidæ* and *Locustidæ*.

The *GRILLIDÆ*, or those properly called Grasshoppers, dwell, as their name indicates, upon the ground, in meadows and fields. They have short thread-like feelers, and their females are destitute of an ovipositor; but both sexes, when flying, produce a stridulating sound by rubbing their saw-like hind legs upon their parchment-like wings.

The *LOCUSTIDÆ* have very long filiform antennæ. The females are provided with a long sword-like ovipositor, and the males are furnished with a spot resembling an eye of glass at the base of each wing-cover, which they rub together, and thus produce their peculiar sound. Their wing-covers, when at rest, are disposed like a slanting roof. Their color is generally bright green, which, after death, soon changes into a dingy yellow, but may be preserved by taking out the intestines of the animal and filling the abdominal cavity with cotton.

Dr. Harris, in his work on the Injurious Insects of Massachusetts, and Mr. Westwood, in his "Introduction to the

Modern Classification of Insects," differ from me, and call the first family *Locustidæ*, and the second *Grillidæ*, probably in order to harmonize with the English translations of the Bible.

According to my classification, an illustration of the *Grillidæ* is seen in the Carolina Grasshopper (*Gryllus Carolina*, Fig. 22), and of the *Locustidæ* in the Katydid (*Platophyllum concavum*, Harris, Figs. 23 and 24).

The Grasshoppers embrace a numerous variety of different genera and species, all of which may be seen in their perfect condition at the beginning of autumn. At the same season, also, the females deposit their eggs, from fifty to one hundred each, some in holes in the ground, others fasten them with a glutinous substance upon different kinds of leaves. From these eggs proceed, in the following spring, the young Grasshoppers, which exactly resemble the perfect insect, except in being destitute of wings; and these are not developed until toward the end of summer, when they commence their ravages among the various kinds of grasses and herbs. On account of their injury to vegetation in many countries, premiums are paid by the public authorities for their collection and destruction. For instance, in the year 1825 the city of Marseilles, in France, paid 6200 francs for collecting and destroying these noxious insects. But again, in many countries they form an article of diet, and the inhabitants of some parts of Asia and Africa use them as food, cooking them by frying them in sweet oil, or by drying and then pulverizing them, after which they are made into bread.

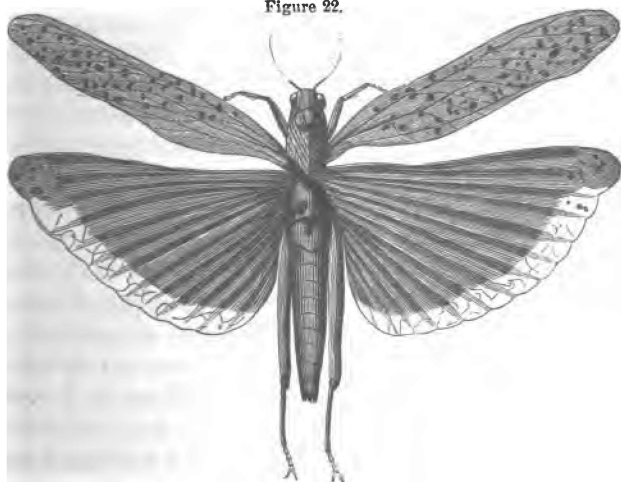
All the Grasshoppers, when taken, try to bite, and in so doing they discharge a brown juice from their mouth, which act probably gave rise to the idea that they were ruminant animals, like our cloven-hoofed beasts, who have more than one stomach. In some parts of France, Germany, Italy, and Hungary, these insects are used as a remedy for warts,

and, it is said, successfully, the people applying them to the parts affected, and allowing them to bite their warts. It is not improbable that the remedy owes its successful effect to the causticity of their saliva, which may act like the lapis infernalis.

Grasshoppers are very often subject to diseases arising from the presence of intestinal worms, particularly the Hair-worm (*Gordius*), which not unfrequently causes their death.

In Germany Grasshoppers are called *Heupferde*, that is, "Hay-horses," because they generally feed on grasses, and their head has something of the form of a horse's head. The French call them *Sauterelles*, that is, "Hoppers."

Figure 22.



Carolina Grasshopper.

The CAROLINA GRASSHOPPER (*Gryllus Carolina*, Fig. 22) is a very common insect of this Order, and is found in great numbers in the months of August, September, and October throughout the United States. So numerous are they, in fact, that one can not walk across a field or meadow with-

out being annoyed with them, as they unceremoniously fly in your face, or alight on your arms, shoulders, and head. This Grasshopper is about one and a half inches long, and with expanded wings about three inches broad. Its wing-covers are of a dusky brown color, and its wings black, with a yellow band on the margin.

But there are also found in the United States a great number of many other species, which are generally distinguished from each other by the color of their wings.

The largest and handsomest species of Grasshoppers are found in South America, one of which I will incidentally mention, as it is commonly found in private entomological collections. This is the *Grillus dux*, an enormous insect, its wings, when expanded, measuring a foot, and its wing-covers beautifully colored red and blue, with black spots. The wings themselves, when not expanded, are folded together like a fan, as is the case with all other species.

But all Grasshoppers, whether handsome or not, are to be considered and classed as noxious insects. They devour every kind of vegetation, and were it not for Nature's great law of compensation, so admirably carried out in our own highly-favored country, this land would long since have been laid waste by the ravages of these rapacious insects. As it is, an abundance of majestic streams, lakes, and ponds water our country from all sides, and by their evaporation afford sufficient rain for moistening the ground and making it fruitful in the production of vegetables for the support of man, as well as rendering it a fit abode for numerous reptiles, such as snakes, turtles, lizards, salamanders, frogs, and toads. Now these reptiles all feed more or less on insects, and in preference on Grasshoppers, of which they annually destroy an innumerable quantity. Hence these hideous reptiles are the instruments made use of by a kind Providence to rid us of a greater evil. We can only form an estimate of the damage that would be done to

vegetation were it not for these reptiles, by comparing our country with the immense prairie lands of the East of Europe, and several parts of Asia and Africa, which are destitute of water and trees, and where for hundreds of miles neither bird nor reptile can live, but where myriads of Grasshoppers dwell in the height of their glory, and nothing green is spared their rapacious jaws.

It is a matter of congratulation, therefore, and an evidence of the wisdom of that gracious rule of compensation, that our gardens, fields, meadows, and woods are peopled with snakes and other reptiles which feed mostly upon these destructive insects. When, therefore, we look with terror on the crawling serpents and the croaking frogs, and are tempted to wish their number less, it is because in their hideous forms we lose sight of their benevolent use; we forget the inexorable decree that has fixed the circle of dependence as the order of all created things; we forget that all must die that others may live; we think not of the hosts of birds, such as Heron, Bittern, etc., who feed mostly upon reptiles, and thereby render a superabundance of the latter impossible; we consider not that these very birds must yield themselves up as food for man, and last of all, that man in his turn must die and also be devoured by insects. And still more we forget, what the open page of Nature clearly shows us, that the moment we begin to live we also begin to die, and that even while we live in all the pride of health we are the constant, daily food of the most despised insects.

But the Grasshopper, although neither large nor terrific in its appearance, has a curious and a wonderful history; perhaps more so than any other insect. It is the same insect whose mode of life and whose ravages have excited the curiosity of Naturalists as well as Historians in all ages. It is armed with two pair of very strong jaws, by which it can both lacerate and grind its food, and although a single

individual can effect but comparatively little injury, yet when the entire surface of a country is covered with myriads of them, and each one makes bare the spot on which it stands, the evil produced by them must be as immense as their numbers. So well do the Arabians know and feel their power, that one of their Poets represents a Grasshopper saying to Mohammed, "We are the army of the great God! we have power to consume the whole world and all that is in it!"

Many ancient and modern authors have given accounts of the almost incredible injuries done to the human race by these creatures; but no one, I believe, has ever yet related that it has actually been necessary to send an army of 30,000 soldiers against them in order to prevent their ravages—a fact which happened under my own observation, and which I shall soon relate.

The earliest records we have concerning the appearance of Grasshoppers on the earth is found in the Bible, where they are mentioned as one of the Plagues of Egypt. That country was then so covered with them that the surface of the ground could not be seen, and all the trees and herbs were destroyed by them. We find this account in the Second Book of Moses, chapter 10th. "And the Grasshoppers went up over all the land of Egypt, and rested in all the coasts of Egypt: very grievous were they. . . . For they covered the face of the whole earth, so that the land was darkened; and they did eat every herb of the land, and all the fruit of the trees which the hail had left: and there remained not any green thing in the trees, or in the herbs of the field, through all the land of Egypt."

It will be noticed that I have substituted the word "Grasshoppers" for the word "Locusts," as it occurs in our English version of the Bible; but I have before shown that the latter word is incorrect, and that the animal designated in Scripture was not similar to our locust or cicada,

but was really identical with the Grasshopper of which we are here speaking. -

According to Pliny, the inhabitants of Cirenaica, in Africa, were particularly subject to the ravages of these rapacious insects, and on that account were enjoined by law to destroy Grasshoppers, in their three different conditions, three times during the year: first their eggs, wherever they could be found, then their young, and lastly the perfect insect. He states also that a similar law was enacted in Lemnos, by which every person was compelled to bring a certain measure of Grasshoppers to the magistrates annually.

“ In the year 591 an infinite army of Grasshoppers of a size unusually large ravaged Italy, and being at last cast into the sea, from their stench arose a pestilence which carried off about a million of men and beasts. In the Venetian territory also, in 1478, more than thirty thousand persons are said to have perished in a famine occasioned by these terrific scourges. In 1650 a cloud of them was seen to enter Russia in three different places, from whence they passed over into Poland and Lithuania, and wherever they moved the air was darkened by their numbers. In some places they were observed lying dead, heaped one upon another to the depth of four feet; in others they covered the surface of the earth like a black cloth, the trees bent from their weight, and the damage done by them exceeded all computation. When the weather became hot they took wing and fell upon the corn, devouring both leaf and ear, and that with such expedition that in three hours they would consume the whole field. After having eaten up the corn, they attacked the wines, the pulse, the willows, and at last the hemp, notwithstanding its bitterness. In 1748 they were again observed in Europe, in Wallachia, Moldavia, Transylvania, Hungary, Poland, and Germany, and, according to the observations made at that time in Vienna,

the breadth of one of those swarms was forty miles, and their length so great as to occupy four hours in passing over the city. So great, also, was the density of this cloud of Grasshoppers that it totally intercepted the solar light, so that when they flew low the air was so darkened that one person could not see another at the distance of twenty paces.”*

The account of a traveler, Mr. Barrow, of their ravages in the southern parts of Africa in 1797, is still more striking. He says: “An area of nearly two thousand square miles might be said to be literally covered by them. When driven into the sea by a northwest wind, they formed, for fifty miles upon the shore, a bank three or four feet high, and when the wind was southeast their stench was so powerful as to be smelled at the distance of a hundred and fifty miles.”

In 1825 the Russian empire was again alarmed by the appearance of an innumerable quantity of Grasshoppers, of which I had the pleasure (if pleasure it may be called) of being an eye-witness.†

I left the city of Moscow in the beginning of the month of April, 1825, in order to visit the Crimea, the Caucasus, and the countries lying between the Black and Caspian seas. Passing through the well-cultivated States (called in Russia Governments) of Moscow, Orel, Resan, Charkow, Kiew, and Woronesch, the whole population of these States expressed in a lamentable manner their fear of perishing by famine on account of the enormous quantity of

* See “Introduction to Entomology, by Kirby and Spence. London, 1818.”

† See *Versuch einer Darstellung des natürlichen Reichthums, der Grösse und Bevölkerung der Russischen Länder jenseits des Caucasus*, von B. JAEGER, *Mitgliede mehrer gelehrten Gesellschaften*. Leipzig, C. H. Hartmann, 1830.—Description of the Natural Riches, Extent, and Population of the Russian Provinces beyond the Caucasus, by B. JAEGER, Member of several Learned Societies. Leipzig, 1830.

the then wingless Grasshoppers which inundated the Desert Prairies between Kiew and Odessa, and between the Don and the Wolga toward Astrakhan and the Caucasus, and which in the following months of May and June would have full-grown wings, and would then fly in endless swarms toward the north in order to devour the luxuriant crops of the well-cultivated fields, meadows, and orchards of those States. I was traveling in great haste, going *about* 14 *versts*, or eight English miles, per hour, night and day (which was then considered great speed), when I was suddenly checked in my speed in the desert prairie lands about 50 miles behind Kiew. Here the ground, as far as the eye could reach, was covered with wingless Grasshoppers, nearly two inches long, and lying piled up one upon another to the height of two feet. Of course the carriage dragged heavily, as if drawn through a deep mould, which prevented the horses from trotting or even walking fast, and the revolving wheels were constantly covered from two to three inches high with mashed Grasshoppers. This state of things continued through the government of Ekatharinoslaw and Cherson to the Black Sea, a distance of about 400 miles. The sight of such an immense number of the most destructive and rapacious insects justly occasioned a melancholy foreboding of famine and pestilence, in case they should invade the cultivated and populous countries of Russia and Poland; and they certainly would have caused such a disaster had not active measures been taken to prevent it. It was in this instance that the Emperor Alexander sent an army of thirty thousand soldiers to destroy an army of Grasshoppers. The soldiers forming a line of several hundred miles, and advancing toward the south, attacked them not with sword and gun, but with more ancient implements, with shovels. They collected them, as far as possible, in sacks and burned them. Notwithstanding this, I found, on my arrival in the Crimea, in the middle of June,

that numbers had escaped, acquired their wings, and had already destroyed a great part of the vegetation.

But the more majestic view of one of their flying swarms presented itself to me in Asia, in the island of Phanagoria, after having crossed the Black Sea at Panticapacum, the modern city of Kertsch, on the Bosphorus. This island is the residence of the Cossacks of the Black Sea, who on that account are called in the Russian language *Tschernomorski*, "Black Sea Islanders." Soon after my arrival in that country, and while continuing my travels, I saw before me, at a distance of about five miles, near the city of Tutmarakan, several thick and solid columns, arising perpendicularly from the ground, like the smoke of a volcano, which at the height of five hundred feet assumed the form of heavy, dark clouds, which soon covered the whole sky, entirely intercepting all solar light.

These apparent clouds were nothing but swarms of Grasshoppers, which in a short time descended to the ground with a shrill, whistling noise, covering an immense area of land which a few hours before was clothed with thick luxuriant grass, and in a few moments after was as barren as a turnpike.

This species of Grasshopper is over two inches long, and of a light brown color. On account of its wandering life, it was called by Linnæus the migratory or wandering Grasshopper (*Gryllus migratorius*). This is the same insect as the one mentioned by Matthew in the 3d chapter, 4th verse, where he speaks of John, saying "his meat was locusts and wild honey," and it is even now a common article of food among several Eastern nations, and particularly among the Arabians.

In the United States we have a large number of different species of Grasshopper, whose characteristics are very similar, and whose ravages would be very extensive, breeding famine and pestilence, if they were allowed to increase and

multiply as they do in other countries. This, however, as has been remarked, is impossible as long as we have so many reptiles and birds to devour them.

The Katydid (Platyphyllum concavum).

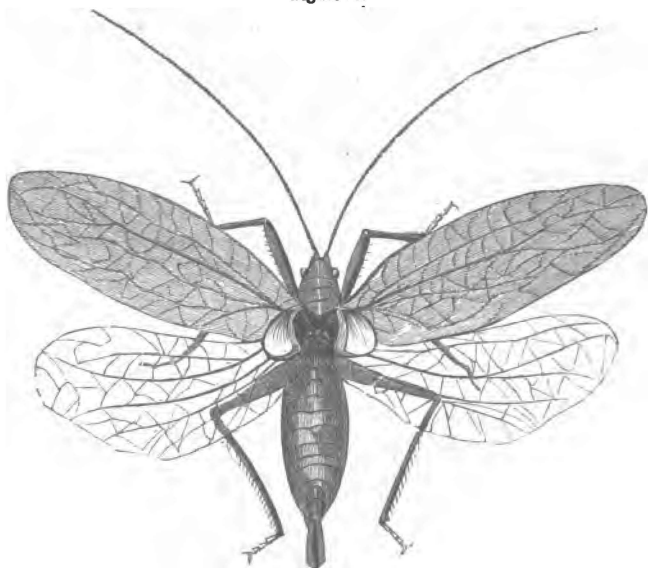
The KATYDID is one of the most conspicuous Grasshoppers of North America. In the cool evenings of autumn its melancholy song reverberates from every tree in our orchards and forests, and its never-ceasing complaint, that Katy did, has not only suggested a thousand pleasant recollections, but has often occasioned many curious and poetical conjectures as to its origin and significance. I use the word significance in its most extended sense, for I know nothing in nature that is insignificant. Every voice, every sound, each warbling note that echoes in the empty air, and every act of animated nature, has some deep, often mysterious meaning. To the thoughtful mind all convey some important moral lesson, either in the garb and soul of poetical association, or by the stronger and more irresistible force of example. The busy bee, that improves each shining hour, can not fail of favorably impressing us with the contentment and the sure success that follows patient and persevering industry. The slimy and venomous reptiles excite our disgust and abhorrence, and unconsciously teach us how to regard their groveling similitudes. The ever constant and faithful dog that bears us company is ever silently but surely impressing upon us the great lesson of fidelity. The gentle lamb, that even "licks the hand just raised to shed its blood," shows us not only

"Blindness to the future, kindly given,

That each may fill the circle marked by Heaven ;"

but it affords us the most striking example of confiding innocence and spotless purity. The metamorphosis of the crawling caterpillar into the beautiful and lively butterfly has in all ages proved a lesson of comfort and of hope to

Figure 23.

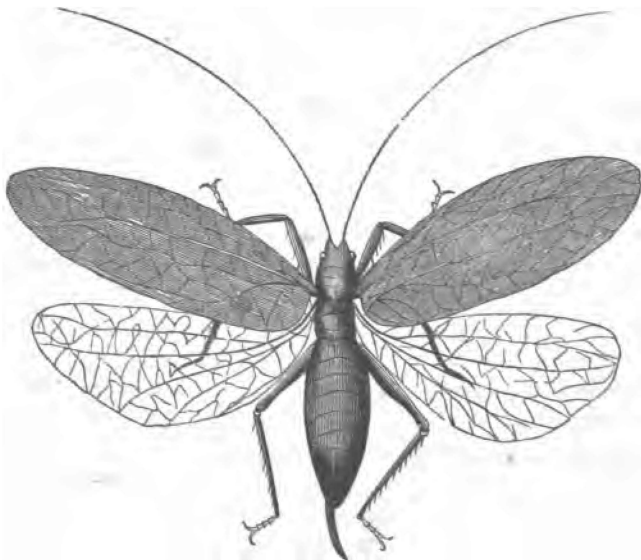


Male Katydid.

man, almost divesting death of its terrors by pointing the soul to its more glorious garb in that higher and purer ether into which it introduces him. So each animated atom of creation bears the stamp of some great moral or intellectual significance, and appeals alike to the poet's enthusiasm, the naturalist's all-absorbing love of nature, the philosopher's burning desire to penetrate hidden mysteries, and to man's universal and unborn conviction that naught was ever made in vain.

Such reflections might be pursued through a thousand various ramifications, and assuredly prove what the contemplation of this little insect *could do*, if they do not satisfactorily acquaint us with what "Katy did." But a facetious poet has asked this little insect tattler what occasioned its

Figure 24.



Female Katydid.

everlasting song of "Katydid," and pretends to have obtained for an answer certain hints as to sundry interviews between a certain Miss Katy and her lover. After describing the happy interview beneath the moon-lit bower of love, and assuring her that he heard every word, however soft and low it fell, he says :

"But never fear me, gentle one, nor waste a thought or tear,
Lest I should whisper what I heard in any mortal ear;
I only sport among the boughs, and, like a spirit hid,
I think on what I saw and heard, and laugh out 'Katydid.'"

"I see among the leaves here, when evening zephyrs sigh,
And those that listen to my voice I love to mystify;
I never tell them all I know, although I'm often bid;
I laugh at curiosity, and chirrup 'Katydid.'"

The Katydid is nearly one and a half inches long, and its wings when expanded are about three inches wide. Its wings are of a pale green, and its wing-covers of a dark green color, which, however, fades away and becomes brown when the insect is dead and dried. This change of color may be prevented, as I have before mentioned in regard to the *Gryllus Carolina*, by taking out its intestines immediately after death, and filling the abdominal cavity with cotton, which is easily done by making a longitudinal incision through the under part of the hind-body with a sharp penknife.

The wing-covers are interwoven with veins resembling those of a leaf, and in the males have a hard, glassy membrane at the base of each, which is shaped somewhat like a human eye, and which, being rubbed together by the sawing-like motion of their wing-covers, produces the sound peculiar to this insect. The poor females are destitute of these musical organs, and are consequently obliged to keep silence and listen to the music of their lords; but they are provided with a formidable-looking sword-like ovipositor at the extremity of the abdomen, with which they pierce holes in the ground for the purpose of depositing their eggs. These eggs are generally laid in the fall, and are hatched out in the ensuing spring.

A very close and interesting observation of the conduct of these insects may be made every autumn by putting a pair of them into a wide glass vessel, having the bottom covered with turf, which, however, must be sprinkled with water every day. As soon as the evening begins the female will commence laying her eggs and depositing them in the ground, and the male will announce in loud tones that Katydid-it. If you preserve these eggs in the turf through the winter, and open them in the following spring, you will find the insect in a perfect condition, except being destitute of wings. It is a very singular fact, and shows the gener-

al deficiency in entomological knowledge, that, numberless though they be, still very few persons can say that they have seen this handsome little insect. It dwells in trees and shrubs, and usually conceals itself during the day under the leaves. I have no doubt that many, if not all, have accidentally met with it, but few except those acquainted with entomology have observed it knowing it to be the famous Katydid; and I have often been surprised, when describing this insect to persons of intelligence who have had every opportunity of noticing it, to hear them say, "I have never seen one." Its voice, however, has been heard by all, and is very generally considered the harbinger of approaching winter.

Fig. 23 represents the male Katydid; Fig. 24 the female, with expanded wings.

There are several other species in this country, all of a more or less green color, and all belonging to the same family; as, for instance, the Sword-bearer (*Conocephalus ensiger*), with a conical head and a very long ovipositor; the Oblong leaf-winged Katydid (*Phylloptera oblongifolia*); the Narrow-leaved Katydid (*Phaneroptera angustifolia*), and several others.

But the tropics furnish many other species, which bear a still more striking resemblance to leaves; and from this circumstance are accordingly named Laurel-leaf, Lily-leaf, Myrtle-leaf, etc.

This close resemblance has been the origin of many fabulous accounts and marvelous stories, namely, that some kinds of leaves are metamorphosed into insects, and living insects are changed into dead leaves, etc., etc.

A certain traveler, in a work on America published several years ago, related the most absurd stories in regard to these insects. He said that on this continent an animated insect often changes itself into a lifeless plant by putting its feet into the ground and allowing them to take root, when

they actually become the stems of a foliated plant; that leaves are sometimes changed into insects with a distinct head, throat, abdomen, and legs. No one, he says, can doubt these facts, as there are in Brazil thousands of witnesses who are ready to prove that they have often observed these phenomena.

Some months ago there appeared an article in several of our newspapers under the title of "Vegetable Insects," in which it is stated on good authority that there is found in Australia a caterpillar which is metamorphosed into a plant.

On closely examining the phenomena, it is found that the caterpillars of a certain Hawk-moth in that country dwell and feed upon the leaves of a certain tree, and that when descending to the ground for the purpose of constructing their cocoons there actually grows out of the body of almost every one of them a vegetating plant, after which the caterpillar becomes dry and hard, and assumes the appearance of cork. Now I suppose this singular phenomenon may be strictly true; and, in order to its explanation, it is necessary to know that fungi, mushrooms, and other vegetable productions of this tribe have extremely fine, small seeds, which are dispersed in the air by the most subtle zephyrs, and which will germinate on every vegetable and animal body upon which they may lodge, provided they find there sufficient moisture for vegetation. If they fall upon the body of the caterpillar, as is probably the case, they will germinate upon it, take root in it, and of course, in developing, will gradually destroy the vitality of the animal, and leave nothing of it but the dried-up, cork-like body with its vegetating fungus.

The same phenomenon has been observed in the Silkworm, which is very often subject to a disease by which its body is completely covered with a white effervescence. The real nature of this distemper was for a long time unknown,

and, in fact, was never ascertained until the year 1835, when Signor Bassi proved it to be a minute fungus, called *Botrytis bassiana*, in a state of vegetation, which had by degrees occupied the whole interior of the body, and then burst through the skin.

The same kind of parasitic growths may occur on the human body, or on any animal or vegetable body, and it is probably the ignorance of these facts that has occasioned so many marvelous and absurd stories by travelers. Simple matters in science may thus become wonderful bugbears to the uneducated. I suppose some would hardly believe that in the tropics a mahogany-tree will gradually change into a gamboge-tree; but this is a fact which I have witnessed, and it can be explained very easily. It is really no more remarkable than our ordinary process of grafting. The seeds of the *Clusia alba et rosea*, a species of gamboge-tree, when fully matured, burst their pods, and, inclosed in a gummy substance, they drop from the tree, like so many caterpillars letting themselves down by a fine filament to the ground. If one of these trees stands near a mahogany-tree, the seeds are blown by the wind, as they swing in the air, against the trunk of the latter tree, and, being covered with the viscid gamboge, they adhere to its bark, take root in it, and in the course of a few years they change its whole character. The trunk and branches of the mahogany-tree gradually decay and drop off, and in its stead grows the gamboge-tree, trunk, branches, and all.

Crickets (Acheta).

The CRICKET has already been immortalized in the English poetry of Cowper, and although its race may become extinct, as long as the languages endure it still must be familiar to all. Its pleasant song, from June to October, during the whole season of tropical illusions, has excited much admiration in the lovers of nature for many ages;

and the pleasing reminiscences of love and of home which its chirping arouses, recently so touchingly portrayed in that admirable little tale of Charles Dickens, entitled "The Cricket on the Hearth," has thrown a charm around its life and history perhaps never before so graphically realized. In fact, Dickens has embodied the superstitious veneration of this little insect, common among the country people of many nations, when he makes his heroine say, "It's sure to bring us good fortune, John! It always has been so. To have a cricket on the hearth is the luckiest thing in the world." And Cowper did the same, years before, when he sung:

"Little inmate, full of mirth,
Chirping on my kitchen hearth,
Wheresoe'er be thine abode,
Always harbinger of good,
Pay me for thy warm retreat
With a song more soft and sweet."

There are several species of Crickets, some of which are found in every part of the world, but all resembling each other in their distinguishing characteristics. They are of different sizes and colors, according to their different species, but all have parchment-like wing-covers, and produce the sound peculiar to them by rubbing the sharp margins of their wing-covers together. Of all insects they are perhaps the most indefatigable musicians, some of them thus fiddling with their wings from daybreak until sundown, and others from evening until the rising of the sun.

There are some Crickets which dwell only upon trees and bushes, and never come to the ground; these are, on this account, called Tree-crickets. Others live only on the ground, and are known by the name of Field-crickets. Others still live in the walls of houses, and are called House-crickets.

The TREE-CRICKET, also called CLIMBING-CRICKET (*Ache-*

ta nivea, Fig. 25), is a very delicate insect, of a pale ivory color, with long antennæ, and a short body, only half an inch in length; its wing-covers are thin, transparent, and ornamented with three oblique, raised lines. Like the Katydid, it is often seen creeping upon the leaves of trees and shrubs, without being recognized as the little creature whose loud and shrill sound is so familiar. Only the male Cricket produces this sound, which it does by elevating its sharp wing-covers very high and rubbing them together very rapidly. The process may be distinctly seen by keeping one under a glass tumbler and watching its movements. They are, however, quite difficult to catch, as they conceal themselves behind the leaves during the day and night, and only occasionally come out of their shady abode.

Figure 25.



The Tree-cricket.

In the beginning of autumn the female makes incisions into the tender branches upon which it dwells, and therein deposits her eggs. These are not hatched until the commencement of the following summer, when the young ones come out, and attain their perfect condition about the first of August, and in southern climates even before that time.

The FIELD-CRICKETS (*Acheta nigra et vittata*) are black, and so well known to every one that a minute description of them would be superfluous. They live in meadows and the margins of fields, where the grass is not very high, and the spot constantly exposed to the sun. They select a small spot of rising ground for their abodes, which they make by digging holes into the ground, at first in a horizontal direction, and then perpendicularly downward. They always walk into their holes backward, that is to say, with their hind legs first, and while singing are usually standing

before the entrance to their abodes, ready to retreat in case of necessity.

They eat grass, seeds, and fruit, and with great industry carry their provisions into their holes, that they may consume them at their leisure. They are very fond of drinking, but are extremely delicate about it, and will only touch the water that adheres to leaves, literally as well as poetically slaking their thirst with only the dew of leaves and flowers. In their journeys they are very careful to avoid water, and if a small stream or puddle happens to be in their way they carry pebbles into it, or grass or small pieces of wood, until they fill it up so that they can pass over it without getting wet; and this instinct teaches them to do, because if they should wet their antennæ they would trouble them by sticking together.

Crickets, when young and before they are provided with wings, live peacefully together under stones, but as they get their growth and wings they become great enemies to each other. The females bite off the legs of the males, and the males themselves are continually fighting with each other. If they meet face to face, they butt one another like rams; and if they meet back to back, they kick like horses.

This quarrelsome disposition of Field-crickets may be made serviceable in getting rid of the House-crickets, for it is only necessary to bring a few of the former into the house, or rooms, which is infested with the latter, and war will take place in the camp immediately.

The youth of Germany, however, are extremely fond of them, and there is scarcely a boy who has not several small boxes made expressly for keeping his Crickets in. They catch them by thrusting a long flexible stem of grass into their holes and forcing them out, and so much delighted are they with their music that they carry their boxes of Crickets into their bedrooms at night, and are soothed to sleep with their chirping lullaby.

The HOUSE or DOMESTIC CRICKET (*Acheta domestica*) is smaller than the Field-cricket, being about one inch long, and of a yellowish color. It dwells in the cracks of walls and floors, particularly in bake-houses and breweries, and wherever else they can find bread, and meal, and moistened grain, for they are always thirsty; and in houses, if they can not get a sufficiency of water elsewhere, they attack wet shoes and clothes. They are provided with wings, with which they fly from place to place, and from house to house; and there have been people superstitious enough to believe that if a Cricket flies from another house into theirs and commences its melancholy song, it is a signal of the death of some member of the family. But such superstitions are not common nowadays; on the contrary, their presence is very generally considered an omen of good, and among country people every where the song of the Cricket is agreeable and highly prized.

It is a true remark that the deepest emotions are those most noiseless. When the patriot Lafayette visited this country many years ago, he was received with distinguished applause and parade wherever he went; the citizens of every city and village through which he passed exerted themselves to the utmost to do him honor, and the country resounded with the merry ringing of bells, with the trumpet of jubilee, and with the booming cannonade. But the greatest compliment paid him, and that which affected his noble heart most deeply, was in a little country village, in which there was no band of music, no firing of guns, no soldiery, no parade, but at the entrance of which the inhabitants met him with uncovered heads and waving handkerchiefs as he passed under the arch they had erected over the road, and which bore this inscription:

“Come then, Expressive Silence, muse his praise!”

And so it is with the mind of man, generally; any thing

that excites the powerful impression of awe or amazement, on the yet more touching and inexpressible feelings of the heart, produces a profound and speechless silence. Lovers and friends, old men and little children, sit silently together for hours, looking at each other in rapt admiration, their souls mingling and blending together, conversing telegraphically with each other in tones that human tongues can not utter, because only human words can dwell on human lips; but the spirit sits above the tongue and has its own peculiar language, which it alone knows how to express. Something of this effect seems to be produced by the chirping of the domestic cricket. People whom the world call brainless, those who can not claim a spark of romance or poetry, as well as those in whom the intellectual fire burns brightest, seem very generally to be calmed into silent, pensive, meditative thought by the mere sound of this little insect rubbing its wings together! What there is in the sound that is attractive, or why it produces such effect, is more than any one has tried to fathom; but the fact is acknowledged by all, and there are few who will not say with Cowper:

"Though in voice and shape they be"
Formed as if akin to thee,
Thou surpassesst, happier far,
Happiest Grasshopper that are.
Theirs is but a summer's song,
Thine endures the winter long,
Unimpaired, and shrill, and clear,
Melody throughout the year.

Neither night nor dawn of day
Puts a period to thy play;
Sing then, and extend thy span
Far beyond the date of man.
Wretched man, whose years are spent
In repining discontent,
Lives not, aged though he be,
Half a span compared with thee."

The MOLE-CRICKET (*Acheta gryllotalpa*) is larger than either of the three species, being about two inches long, and distinguished from the others by having very wide mole-like fore feet, very short wings, and short hind legs. Its body is of a grayish color, and its feet are brown.

From the peculiar construction of its fore feet it may readily be inferred that it acts in the same manner under ground as the mole, and so it does; it feeds on the roots of plants, and is sometimes very injurious to our gardens and meadows. This insect is scarcely ever seen above ground, but its presence may easily be detected by the withering blight that marks its subterranean ravages. We frequently see large spots of grass in our meadows becoming yellow, and drying up, because its roots are devoured by the Mole-cricket, which dwells under it. These insects would prove much more annoying and injurious to us, were they not constantly being destroyed by moles, lizzards, and snakes.

Cockroaches (Blatta).

The COMMON COCKROACH (*Blatta orientalis*) has been so universally known in the Old and the New World for ages, that it is almost impossible to ascertain whence it first originated. Suffice it to say that it has a flat body, about an inch long, of a dirty yellow or black color, and long awl-shaped antennæ, each of which is composed of eighty joints.

Cockroaches, as is well known, are very voracious, and devour every thing that comes in their way, and as they are at the same time very prolific, they should always be destroyed when encountered. This may be done by pouring boiling water upon them, or suffocating them with sulphur smoke. Many houses in St. Petersburg have been so infested with them that it has actually been necessary to burn them down in order to get rid of these noxious insects.

Ear-wigs (Forficula).

THE COMMON EAR-WIG (*Forficula auricularia*) is about one inch long, and has yellowish legs and a brown body. Its upper wings are very short, but the under ones are as long as the whole body, and will expand like those of a butterfly, making it seem almost impossible that they can be so folded up as to have room enough under their short wing-covers.

These little animals present one very extraordinary phenomenon among insects; they are not only oviparous, but they bring forth their young by incubation; and during the month of April the females may always be found under stones, sitting upon their eggs like a hen. The young are hatched like chickens, and in the month of June may be found with their mother, resembling her entirely, with exception of the wings.

It has long been a prevalent popular superstition that the Ear-wig creeps through the ear into the brain of sleeping persons, and thus occasions their death. But an instance of the kind has never come to light, and we can easily believe it impossible, as their jaws and abdominal pinchers are not strong enough to admit of their doing any such injury. They are, however, justly persecuted and destroyed by gardeners, because they make holes in ripe fruit, as peaches, apricots, pears, and prunes, and feed on them. They are also very prone to conceal themselves in pink flowers and dahlias, when in full bloom, and spoil them. On this account, gardeners often suspend lobster-shells, reeds, etc., on these plants, that the Ear-wigs may conceal themselves in them instead of the flowers.

The Soothsayers (Mantis).

THE SOOTHSAYERS are distinguished by an unusually long, flat hind body, a perpendicularly-erected long neck-like thorax, short, horizontally-folded, generally green, or

grayish brown wings, two very long fore legs, which are continually stretched out to catch insects, and two short antennæ. They have received the name *Mantis* from the Greek word signifying "Soothsayer," on account of their curious motions, and that of "Camel-cricket" from the great length of their neck.

They are very seldom found in the Middle or Eastern States of the Union, but are seen in Maryland and all the Southern States, and several species are found in the tropics. They dwell upon the leaves of trees and bushes, walking very slowly upon their four hind legs, or sitting stationary for hours, like the chameleon, waiting for their prey. As soon as they perceive a fly or a caterpillar approaching, they turn their heads on all sides, watching its movements, then they creep toward it slowly, like a cat after a mouse, until, with the rapidity of an arrow, they pounce upon it and grasp it with their sharp-pointed fore feet. Having devoured their victims, they resume their former position, and sit stationary, holding up their fore legs as if in the attitude of prayer. Hence the country people of France, assuming that it is engaged in prayer, call this insect "*Prie Dieu*;" the Italians, "*Prega Dio*;" the Germans, "*Gottes-Anbeterinn*;" and the Latin names of "*Mantis religiosa, precaria, sancta, superstitiosa, oratoria, mendica, pauperata*," etc., which have been applied to it, are derived from the same superstition.

In the life of the celebrated missionary, St. Francis Xavier, we read "that when he saw a Mantis holding up its arms in deep devotion, he asked the insect to sing the praises of God, whereupon it chanted a very fine canticle."

Sparmann, a distinguished traveler in Africa, informs us "that this insect, the Mantis, is worshiped by the Hottentots as a tutelary divinity; and if it happens to alight on any person, he is at once considered as the peculiar favorite of Heaven, and is looked up to as a saint."

In what a different light does the naturalist look upon the Mantis! This cowardly and cruel insect, which is itself afraid of a little ant, can only be regarded as in the attitude of those whom the poet describes as

“Borrowing the livery of Heaven to serve the Devil in,”

if its position may be allowed any practical association at all. It holds up its anterior tibiae merely for the purpose of catching and destroying flies, caterpillars, plant-lice, and other luckless insects who may come within the reach of its forcep-like fore feet.

These insects, according to the observation of all naturalists, are very warlike, voracious, and, did our limits allow, we should quote many very interesting accounts of them from the works of that eminent German entomologist, Roesel. Like Reaumur, in France, he was occupied the greatest part of his life in making observations concerning the life, habits, manners, use, and injury of insects; and published the result of his labors in four volumes, from 1746 to 1761, under the title *Insecten Belustigungen*—“Entomological Amusements.” Roesel was born in Germany in 1705, was a contemporary of Linnæus, Buffon, Tournefort, and Jussieu. In the early part of his life he practiced miniature painting in Nuremberg, but afterward devoted himself entirely to the representation of insects, which he drew from nature with uncommon accuracy. He then wrote his valuable and classical work on that branch of Natural History, and illustrated it with plates. He died in 1759.

To witness the warlike disposition and cruelty of these soothsayers, it is only necessary to put several of them in a box together, when they will immediately commence fighting, furiously striking at each other with their long fore legs. The males are considerably smaller than the females, and in these encounters generally fall victims to the vo-

racity of their "better halves," who cut off their heads and then devour their whole body piecemeal.

The Chinese, aware of their cruel and warlike propensities, keep these insects in bamboo cages, and exhibit them as prize-fighters, as is done with fighting-cocks. At these exhibitions, when two Soothsayers are placed face to face, they become at first still and immovable; but after they have gazed fixedly at each other for a while, they raise their wings, their whole body begins to tremble, they become furious, and pounce one upon the other, giving blows with their long fore legs, which they use as if they were swords, and fighting as fiercely as the enraged Hungarian hussars in the last war with Austria. At last one of them yields, and the conqueror grasps the vanquished one and devours him by pieces.

The eggs of the Soothsayers, in the autumn, are deposited in an oval mass attached to the twigs of some creeping vines near its base. This mass is inclosed in a silk-like covering, resembling a seed-pod, which contains from fifty to one hundred eggs, and which remains in this condition during the winter, like the cocoons of butterflies and moths. In the beginning of the following summer the larvæ issue from these eggs, and exactly resemble the perfect insect, except in being destitute of wings. If these are kept in a glass together, they will soon exhibit the warlike disposition of their parents, and devour one another, unless they are abundantly fed with plant-lice, of which they are very fond. On this account, notwithstanding their fierce and quarrelsome disposition, they become indisputably useful in destroying noxious insects.

The life of the Soothsayer continues scarcely two seasons. It is hatched at the end of spring, becomes perfect in the course of the summer, and dies generally toward the end of October.

The Walking-stick (Spectrum).

The WALKING-STICKS, as this English name indicates, are very fantastically formed. They are straight longitudinally, like the stem of a pipe, slender, and some of the tropical species are more than a foot long. They are the largest in proportions of the whole class, and, on account of their length, may be considered the whales among insects.

They somewhat resemble the Soothsayers, but their fore legs are not sabre-like, nor adapted for catching insects. They are not carnivorous but herbivorous, and are destitute of wings; and although they feed on plants, they are not injurious to vegetation, because they eat principally useless weeds and the juices which issue from trees. Their antennæ and legs are very long, and always extended; and as their bodies are of a gray or yellowish and brown color, it is often difficult to discover them, or to distinguish them from the branch on which they stand, as the insect is often motionless, with the legs extended in a straight line resembling the lateral twigs.

In my excursions I have never met the Walking-stick farther north than Maryland and Virginia, where I have seen them in great quantities in the month of September, either standing motionless on the twigs of trees or on the rails of fences. At my approach they invariably took the opposite side of the twig or rail, in order to evade observation. The Hon. Prescott Hall, of New York, however, recently informed me that he has observed them abundantly at his summer residence in Newport, Rhode Island.

The late Thomas Say held the same opinion that I did, and believed this animal to be only indigenous in the Southern States, until he was corrected in this respect by Mr. Charles Pickering, of Salem, Massachusetts, who informed him that he had obtained one near that city.

These insects are mostly all exotic, and, according to

Westwood, there are found in the south of Europe three species; in South America, twenty species; in North America, three species; in Asia, forty species; in Australia, twenty-seven species; and in Africa, two species.

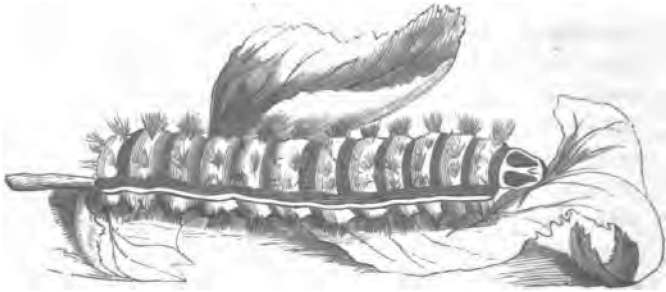
Mr. Say, in his *American Entomology*, has given a good illustration of the *Spectrum femoratum*, in plate 37, and of the *Spectrum vittatum*, in plate 38, to which I refer the reader.

It is much to be regretted that death has taken from us this highly distinguished American naturalist; but his works are left behind him, and will insure him long remembrance among all lovers of Science and Nature. Mr. Say accompanied Major Long in his exploring expedition to the Rocky Mountains many years ago, and afterward traveled with Mr. M'Clure through Florida and other countries. He published his *American Entomology* in 1824, in three volumes, with fifty-four very-well executed colored plates, and is the author of a great number of valuable articles contained in the Transactions of several of the learned societies of the Union. Thomas Say was a member of the Society of Friends, Curator of the American Philosophical Society, Professor of Natural History in the University of Pennsylvania, and of Zoology in the Philadelphia Museum.

ORDER IV.

MOTHS AND BUTTERFLIES—(*LEPIDOPTERA*).

Figure 26.



Caterpillar of the *Saturnia Io*.

WE now approach the most beautiful and, to the generality of people, the most interesting department of Entomology. The splendor and variety of the insects of this order has never failed to attract attention, and with all lovers of nature nothing more readily or more universally excites the mingled emotions of pleasure and astonishment than the careful examination of a rich collection of Moths and Butterflies. The endless diversification of colors, which are distributed in different forms upon the bodies and wings of lepidopterous insects, and even upon the bodies of caterpillars, some in lines, others in circles, or eyes, or hieroglyphics, or letters, and all in ever-varying shape and hue, can not fail to excite our admiration, and impress upon us the conviction that even the most diminutive creations bear the same stamp of pleasing and infinite variety which per-

vades the universe. Of all the glittering orbs that roll in endless space, probably no two are alike in substance or living contents. So, of all the myriads of living creatures with which the earth has swarmed since the animating Spirit first breathed upon chaos, no two can be said to be precisely alike; but, on the contrary, so inevitable is the law of variation with regard to all the operations of nature or art, that all similarity is rather relative than real. The animal, the vegetable, and the mineral kingdoms in all their developments, show the same endless diversification. In the human family, even, the highest and most perfect of animals, we see multitudes of different forms and colors, of languages, and manners and customs. We find an immense variety of beasts and birds, reptiles, fishes, and insects; and the same of plants, trees, and shrubs, as well as of all the mineral productions. And yet we find all these different varieties of the three natural kingdoms united under one general law; all dependent upon one another, as component parts of one great universal whole, and we are forced, with the great philosopher, Humboldt, to exclaim, "Nature is the unity in variety."

Moths and Butterflies, in comparison with the other orders of insects, are well entitled to the rank of nobility, for among them we find no impudent beggars and spongers, as among the flies; no parasites, as in some of the wingless insects; no working class, as among the hymenopterous insects, bees, wasps, ants, and gall-flies; no musicians, as among the families of Crickets, Grasshoppers, Katydid, and Cicadas; but all of them are aristocratic idlers, who, clothed with silver, and gold, and purple, and ornamented with ever-varying splendor, have naught to do but to seek their own pleasure, and charm away their brief existence fluttering from bough to bough, and satiating themselves with the sweet nectar of flowers.

And, indeed, whether we look at them in their infancy

as caterpillars, or in the state of chrysalis, or in their perfect condition, they are always more beautiful and more interesting than all other insects, and attract more of our attention; when in the state of caterpillar, on account of the injury they do to vegetation, and when in their perfect form, on account of their splendor and variety.

Moths and Butterflies are distinguished from other insects by having four expanded wings, with a few exceptions, covered with colored scales, and hairy bodies. They are oviparous animals, and, under the guidance of their instinct, lay their eggs upon those plants which are best adapted for sustaining their future progeny. From these eggs proceed the caterpillars (*larvæ*), many of which are so voracious that they consume more than twice their own weight in twenty-four hours. We may congratulate ourselves that they are so small, and that we and our domestic animals are more moderate in our appetites; for if a man weighing one hundred and fifty pounds consumed every day three hundred pounds of food, or an ox weighing four hundred pounds devoured daily eight hundred pounds of grass, our terrestrial globe could not, in its present condition and extent at least, produce sufficient nourishment to sustain us or them.

After it has attained its full growth the caterpillar stops eating, casts its skin, and becomes a chrysalis or cocoon (*pupa*). Some suspend their cocoons from the branch of a tree, as, for instance, the *Asterias*; others bury themselves in the ground, as do all the Hawk-moths, and in this condition remain throughout the cold winter season. Thus the chrysalis passes its life in a state of torpor, without eating or moving, until, after a shorter or longer period, it bursts its skin, and the perfect butterfly or moth issues, no more to injure vegetation, because it has exchanged its mouth for a spirally rolled tongue, with which it can only suck the juices of plants and flowers.

In this metamorphosis some very great changes occur in

the appearance and beauty of the insect, as well as in its form and structure. Some of the handsomest caterpillars issue from their cocoons the plainest, even the ugliest looking butterflies, and *vice versa*. Thus the potato-worm is remarkable for its beautifully variegated colors, but when it becomes adult as a hawk-moth it has a uniform dingy gray color. But the contrary is often the case, and an insignificant-looking caterpillar is as often metamorphosed into a very handsome butterfly.

Such changes, however, are not confined to insects, but are also common throughout the animal kingdom, as well in the highest as the lowest classes, and would seem to be something more than a mere freak of nature.

But the metamorphosis of Butterflies and Moths has always been a subject of interesting contemplation and of profound analogical reasoning, and has ever been considered the true type of man's existence here, and his brighter and happier life hereafter. In the most ancient times it probably gave origin and strength to the belief in the transmigration of souls, metempsychosis, as also to a thousand fabulous stories and fairy tales, in the same manner as the annual casting of the skin of snakes, by which process that reptile appears every spring in a new dress of bright and glittering colors, has given rise, even in the remotest antiquity, to the idea of regeneration and endless life hereafter.

Caterpillars, notwithstanding their beauty, are very generally disliked on account of the immense injury they do to vegetation; but the prevailing prejudice against them, in my opinion, arises more from the general ignorance of their uses, and the benefit they are capable of conferring upon man, than upon the actual amount of damage done by them. We will mention some of their uses, and again endeavor to convince our readers that none of the works of nature are so insignificant as to be wholly without use in the great plan of economy.

Caterpillars very often inform us as to the properties of the plants upon which they feed; thus the Potato-worm (*Sphinx Carolina*) feeds only upon the different species of the night-shade tribe (*Solanææ*); for instance, on the egg-plant, the potato and tomato-vine, etc.; the Asterias (*Papilio asterias*) lives upon the leaves of the umbrella tribe (*Umbelliferaæ*), as the parsnep, cicuta, parsley, caraway, anise, celery, etc.; and the Danaus (*Danaus plexippus*) feeds only upon the different species of milk-weed.

The excrement of caterpillars furnishes an excellent dye-stuff, and their bodies the finest of varnish. It is well known that the body of each caterpillar is provided with a glutinous substance, by which they are enabled to manufacture their cocoons; and to obtain this they are collected in many countries in large quantities, and boiled in water until a greasy liquor is seen floating upon the surface. This oleaginous substance is skimmed off, and proves a valuable varnish. It is said that the Japanese use this to varnish their finest fancy articles.

Raising caterpillars for the purpose of obtaining from them perfect butterflies or moths is not only an agreeable and instructive operation for young pupils in their leisure hours, but it has often been a very lucrative business. In Altona, in Denmark, I became acquainted with a gentleman who raised in his conservatory several species of the large moths, natives of North America—as the Cecropia, Luna, Polyphemus, and Promethea—which he sold readily at two dollars apiece, and of which he raised on an average a thousand specimens a year.

Caterpillars are of quite an important use to man as the principal food of birds, and the amount of good they do in yielding up their lives as nourishment for others would astonish one unaccustomed to reflect upon the subject, and really goes far toward compensating the injury they do to vegetation. There are at least 1200 species of lépidop-

ferous insects in existence in this country, and as each female lays on an average 300 eggs, half their number, viz., 6000 females, will produce 1,800,000 caterpillars; in the second generation, 180,000,000; and in the third, 27,000,000,000.

If such an immense multiplication of so voracious an animal were to be continued without any check, man and beast would soon be destroyed by starvation; but it is undoubtedly one of the designs of Nature that these should increase immensely for the very purpose of furnishing sufficient nourishment for the birds and other winged animals which make them their principal food. It is ascertained that a single robin or woodpecker, and many others of the warblers, carry every day about fifty grubs or caterpillars to their nests as food for themselves and their young.

Now if there were only one million of these birds, of which each one devours 6000 caterpillars during the months of April, May, June, and July, by no means a large computation, the number of caterpillars and grubs thus destroyed will amount to 6,000,000,000 annually.

Caterpillars are, therefore, of great use to us in furnishing so abundant food and nourishment for the birds, which enliven and embellish the country with their happy songs and their beautiful plumage, and which themselves supply us with a palatable and delicious article of food.

Caterpillars are also destroyed by various kinds of vein-winged insects, principally by different species of the Ichneumon fly, which with her ovipositor thrusts one or several eggs into the body of the caterpillar, upon the flesh of which the maggots of these flies subsist, until they come out as perfect flies, of course destroying the larvæ upon which they feed. We can often see this process carried on upon the body of a potato-worm, when it is full grown, and just ready to change into a cocoon. It will be completely covered with many hundred minute white silk-like bodies, which

look like grains of rice, but which are nothing but the cocoons of small Ichneumon flies, which have been raised in the body of that caterpillar, and work themselves out of its skin when ready for their own metamorphosis into a cocoon. This change takes place very rapidly, and then they fall to the ground to await their final transformation into a perfect Ichneumon.

Lastly, caterpillars are not only indirectly useful to man, but they are directly of the greatest importance to him; they not only indirectly furnish him with palatable food, but they directly supply him with his costliest and most beautiful apparel. What a rebuke for human pride! The gaudy and spangled robes that deck earth's greatest potentates are originally woven by the despised worm that crawls beneath their feet! What a profound lesson in the economy of nature, and how striking an illustration of the dependence of all created things! An apparently insignificant caterpillar becomes one of the most important articles in the manufacture and commerce of the world. An infant butterfly weaves its own beautiful colors into a texture that becomes not only the splendid and appropriate ornament of female beauty, but also the insignia of office, rank, and power. The academic gown, the priestly vestments, and the monarch's royal robes were all once inclosed within the cocoon of a silk-worm.

This caterpillar is the most renowned and the most profitable of all, and is extensively cultivated in France, Italy, Greece, Turkey, Persia, China, and Transcaucassia,* and might as well be cultivated in this country, if the importation of foreign silk and the tariff did not operate against this branch of industry. We have, however, quite a number of Moths, indigenous to this country, the cocoons of which might also furnish a very valuable, strong, and ex-

* See B. JAEGER'S *Versuch einer Darstellung des natürlichen Reichthums der russischen Länder jenseits des Caucasus*. Leipzig, 1830.

cellent silk, and of which extensive use will probably be made as soon as the young giant of North America arrives at maturer age. Of these I shall speak at length in some of the following pages.

Various kinds of apparatus have been invented for the purpose of raising caterpillars, and the simplest kind are boxes, the bottom of which is covered with earth, and the top with gauze, so as to admit of fresh air at all times. In some places large cages, like those for birds, are used, which are also covered with gauze, and in which are placed the different plants upon which the caterpillars feed. This is a very convenient contrivance for observing their mode of living, the casting of their skins, and their metamorphoses, as also for obtaining handsome and perfect specimens for the cabinet. They may be raised, however, in the same manner as silk-worms are generally raised, and which we shall presently describe.

As soon as the cold of autumn deprives the trees and shrubs of their foliage all caterpillars disappear, either metamorphosing themselves into cocoons, or, if not yet ready for such a change, concealing themselves under the ground. In the following spring, as soon as the new leaves appear on the trees, they come out from their caverns in the hollow trees or the crevices of the rocks, and with a host of new ones that issue from the eggs which were deposited in the previous autumn, they commence their ravages, devouring all the new leaves and shoots within their reach.

After the caterpillars have cast their skin several times and are full grown, they metamorphose themselves into an immovable cocoon (*chrysalis*, *aurelia*, *pupa*), which eats no more, and under the horny skin of which may almost always be recognized the wings and other members of the future Butterfly or Moth. Many of these come out after a few weeks, during the summer, again lay their eggs, from which proceed other caterpillars, which latter generally

pass the winter as cocoons, exposed to rain, snow, and the severest cold without the least injury.

A few Butterflies, however, are not unfrequently seen on warm sunny days in the middle of winter; as, for instance, the Thistle Butterfly (*Vanessa cardui*), or the Mourner's Mantle (*Vanessa Antiope*). These individuals came out from their cocoons late in the fall, and made their winter-quarters in hollow trees.

As the habits and mode of life of Moths and Butterflies, and even their forms and organs are quite uniform, while on the contrary those of their caterpillars are very manifold and diverse, the careful observation of the latter seems to offer greater satisfaction to our curiosity, and I deem it important to speak more at length concerning them.

Caterpillars have two kinds of feet, viz.: three pairs of horny ones under the neck, and a number of fleshy ones under the remaining parts of their body. The greatest part of these insects have eight pairs of feet, some genera seven, others six, and others only five, or even four pairs of feet. Those that have eight pairs of feet walk very slowly and uniformly on the ground, but all that have less than that number walk differently; they can not progress with their body extended horizontally, but when creeping forward form an arch with the middle part of the body, which is destitute of legs, by approaching their hind feet to those of the thorax, and then advancing with the forepart of the body in the same manner as we move the hand when measuring a span with the thumb and forefinger. On this account these caterpillars have been called by the common people tailors, and by others geometræ, or surveyors. Those caterpillars which have only four pairs of feet are able to stand erect on their hind feet for hours, forming an acute or a right angle, and in this motionless position resembling a little twig of the shrub or tree upon which they are standing.

Caterpillars are generally covered with very handsome

colors, and even the plainest looking will appear handsome upon a close examination with a magnifying glass. The size of their bodies varies very much in proportion to the size of the perfect insect, and their exterior surface is either smooth, as that of the *Asterias* on the parsnep (Fig. 29), or that of the *Danaus* on the milk-weed, or it is hairy like that of the *Saturnia* (Fig. 26) on Indian corn and other grasses.

The food of caterpillars, with a few exceptions, is taken from the vegetable kingdom. Some feed exclusively on one species of plant, as the silk-worm on the white mulberry; others on all the species of one genus, as the potato worm on the tomato, potato, etc.; others eat any kind of vegetable, as the woolly-bear (*Arctia*). The periods of taking their meals is also different; some eat only in the morning and evening; others during the whole day; and others only at night, while they conceal themselves during the day, and their depredations only are visible. But if by night we examine our cabbage, cauliflowers, and turnips with a lantern, we shall often find them covered with a host of these noxious individuals.

Many of the caterpillars live like hermits, a solitary life, and pay no attention to their brothers and sisters; while, on the contrary, many species are real socialists, and build in common their comfortable silk dwellings, with which, if not prevented by man, they sometimes cover entire trees. Here they live, and feed together at regular hours; as, for instance, the Tent Caterpillar (*Climacampa Americana*, Harris) on apple, pear, or cherry trees, and by such confraternities the trees of an entire orchard are ruined, unless the destructive intruders are destroyed in April or the beginning of May.

Single parts of Caterpillars.

HEAD.—The head of a caterpillar is horny, of a globular or oblong form: it contains a mouth with an upper and

under lip, between which are sharp, horny jaws, with which they cut transversely the leaves, beginning at the margin. They cut with their jaws as easily and in the same manner as we do with scissors.

Although we can not distinguish in them any organ of vision, it is more than probable that they are provided with eyes; for if we examine them with a magnifying glass we discover on each side of the head six black spots in a circle, which seem to answer the organ of sight; and if we approach them in the night with a light, they immediately begin to move, which shows that they must have some means of being affected by the light. Besides, their motions in various voluntary directions testify much in favor of such an opinion, although it is possible that these may be detected by their exquisite sense of smell.

There is no caterpillar which does not spin a web of some kind, by issuing a thread from a fleshy point of the under lip.

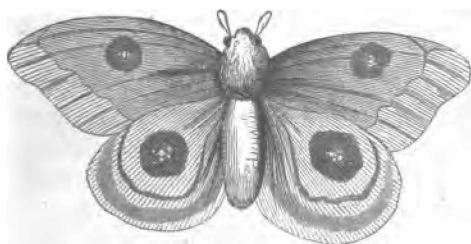
BODY.—The body of a caterpillar consists of twelve ringlets, upon nine of which, on each side of the ventral portion of the body, is seen an oval spot, surrounded sometimes with a red or yellow ring. These oval spots are the respiratory organs by which the insect breathes. That these are the real respiratory organs is proved by putting oil or any greasy substance over these air-holes, the consequence of which will be immediate death by suffocation. Moreover, if a caterpillar is put under water or alcohol, air-bubbles will be seen issuing from innumerable minute holes in all parts of its body; and when the skin is taken off from the insect and held up against the light, the holes may be distinctly recognized, and the whole skin will appear as if it were perforated with an immense number of fine pricks.

Inside of the body, every caterpillar has a stomach, a heart, an intestine, and two long serpentine organs, which ex-

tend to the hind part of the body, and thence back to the neck, where they open at the inferior lip. Those tubes contain the substance which the animal uses in spinning, which is a yellow or white juice, according to the food it takes, and upon this also probably depends the fineness of the silk they make, in the same manner as the quality and color of butter depends upon the food of the cow.

These tubes joining together and opening at the under lip, constitute the spinning apparatus of caterpillars, and may be distinctly seen by opening with great care and caution the back of the animal. The juice contained in the tubes is nothing more nor less than a kind of very fine varnish, of which the people of some countries make use, but which no one has yet undertaken to use in this country. Should this varnish ever come into general use, our most noxious caterpillars would become beneficial to us.

Figure 27.



Saturnia Io.—Male.

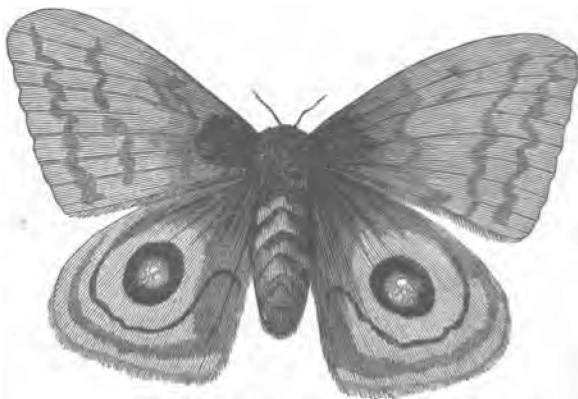
The single parts of Moths and Butterflies, although not quite as varied and complex as those of caterpillars, still present some points of interest and curiosity, and far excel them in beauty and splendor.

The four wings of Moths and Butterflies differ from those of other insects, by being covered with a kind of dust, which produces the handsome colors, and which, when touched, sticks to the fingers. Under the microscope, it is seen that

this dust has regular forms, and consists of horny scales, fastened in the wings. From this circumstance the order of entomology comprising Moths and Butterflies is called *Lepidoptera*, which signifies in English "Scale-winged."

The head of these insects is provided with two large globular eyes, covered with a horny skin, which under the magnifying glass looks like a net-work, consisting of a number of elevated points or convexities, of which each one may, perhaps, be considered a single eye. This horny skin is transparent, and when taken off and looked through, for instance, at one man, there are presented to us a whole army of Liliputians. But in spite of this multifarious vision, the insect probably sees only that object which is in the direct angle of vision, or which is in a straight line with its point of sight.

Figure 28.



Saturnia Io.—Female.

On the upper part of the head, between the eyes, are seen two thread-like filaments, called "feelers," antennæ, as in the *Saturnia Io* (Figs. 27 and 28), and in the *Asterias* (Fig. 30). The use of these organs has not yet been exactly

ascertained. Some naturalists think that these feelers serve to protect the eyes, but the more rational opinion prevails that the antennæ, with which all insects are provided, are probably the organs of hearing. They are hollow, provided with muscles, and placed on each side of the head, like the ears of beasts, reptiles, and fishes.

The use of the proboscis is much better known: it is a spiral tongue, formed to coil up like the spring of a watch, and it is by means of this organ that the insect is enabled to pump out the juice of flowers. This spiral tongue, which answers the purpose of a mouth, is placed between the eyes, and consists of two lateral halves which are closely united, and which form a hollow tube like the proboscis of an elephant. Its length varies considerably in the different species of butterfly. We find the longest ones in the Hawk-moths; but a few species have none at all, as the silk-worms, for many live as perfect insects only a few days, and can get along without the trouble of procuring food.

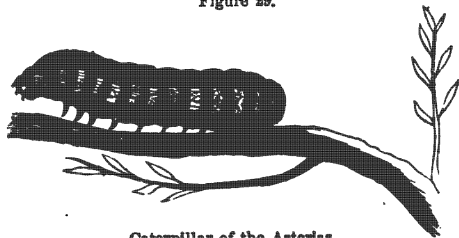
I have often amused myself with experiments upon the Hawk-moths and Butterflies which were hatched in a warm room as early as the month of March. I have fed them with sugar, holding the insect in my fingers by the wings, and have seen them seize the piece of sugar with their fore feet and, thus holding it, unfold their proboscis, and with its saliva moistening the sugar, then sucking the juice, which could easily be perceived ascending the trunk. This is an experiment which every one can make at pleasure.

From the most ancient times it has been observed that some lepidoptera make their excursions only during the night, and conceal themselves during the day; while others are seen flying about only in the daytime, and conceal themselves at night. The former are called Nocturnal Lepidoptera, as Moths, Millers, Hawk-moths, etc., which are recognized by their having antennæ without a knob at the end, *e. g.*, the *Saturnia Io* (Figs. 27 and 28).

These insects are rarely seen by day, being concealed on or under fences, or houses, or under the leaves of trees and bushes, and you have only to strike upon a bush with your walking-stick, or parasol (for I write also for the young ladies), when a swarm of these insects will sometimes fly out of it, and be easily caught in a net. As soon, however, as night sets in, their airy promenades begin, and unless snapped away by the cruel whip-poor-will, or a voracious bat, or burned alive by the flame of some candle, they continue flying about all night.

It is very singular that nocturnal insects, which conceal themselves from the daylight, are so apt to fly toward a light in the night. But such is the fact, as almost all can testify who have seen them flying around a light in a warm summer evening, when the windows are open, until they disabled themselves, so that they could not fly. This is another way of catching these insects; and still another is to spread a white sheet over the turf of your garden in a warm summer evening, and set a lantern in the midst of it: numerous swarms of guests of all shapes and colors will immediately appear upon it.

Figure 29.



Caterpillar of the Asterias.

But if we examine these insects, which are so much attracted by the light, we find the greatest part of them males. Hence the celebrated and ingenious Professor Oken thinks that the females of the nocturnal lepidoptera

may, perhaps, be provided by nature with some luminous spots, visible only to their males, but not to man.

The Diurnal Lepidoptera, called Butterflies, are seen flying only during the daytime, and are distinguished from the preceding ones by having a knob at the extremity of each antenna; as, for example, the *Asterias* butterfly (*Papilio asterias*), Fig. 30. Of these we shall speak again.

Fig. 30.

The *Asterias* Butterfly.

Of Nocturnal Lepidoptera.

The romantic imagination of naturalists has often taken from ancient mythology the names of gods and goddesses, or of fabulous heroes and heroines, with which to distinguish the most splendid of the lepidopterous insects. Thus we have among them an Apollo, Mars, Cybele, Iris, Atropos, Ulysses, Ajax, Nestor, etc. This was the case with the first Nocturnal Moth of which I shall speak.

In the months of June and July, if we look on the dog-

woods, elms, sassafras, or poplars, we find upon their leaves a number of small pale-green caterpillars, covered with clusters of light-green short prickles, and having a brown and white longitudinal stripe on both sides of the lower ventral part of the body, and extending from the head to the abdomen. These caterpillars live together very socially during their infancy, but disperse at mature age, and travel about through meadows and gardens, where they are often found upon the leaves of clover, Indian corn, and other grass-like plants, upon which they feed.

One of these caterpillars is represented in Fig. 26, and when full grown is more than two inches long. Its fine colors attract many a young person, who soon finds himself affected to tears by the sharp pains of its prickles, which sting like nettles.

It is easy to raise these caterpillars, as their food can so easily be procured, consisting of elm and poplar leaves, or any kind of grass. After having cast their skin four times, and when they are about seven or eight weeks old, each one looks out for a large leaf on the ground, the margins of which it fastens together in an irregular form, then lines the inside with gum, in order to make the cocoon stiff and impenetrable to the inclemency of the severest weather. In this condition the chrysalis remains through the whole winter and until the following summer, when they awake by the spiritual rapping of the warm element, rise from their graves clad in an orange and purple dress, and ascend toward the sky as perfect moths.

This Nocturnal Lepidoptera received its name after Juno, the daughter of Saturn, also called Saturnia, and her priestess, Io.

The *Saturnia Io* is represented in Figs. 27 and 28, the male with four, and the female with two globular, black spots on the wings. The female is the larger, and differs in color.

The Silk-worm Moth (Bombyx mori).

Of all the lepidopterous insects this is the most celebrated and the most useful to man, and consequently deserves as extended a notice as the limits of this work will allow. It is generally known that most of the caterpillars, at the period of their metamorphosis, envelop themselves with a silky web, which forms the inner part of the cocoon. But it is not, perhaps, so well known how this silk is obtained from the caterpillar, nor to what extent this most valuable of all the products of insects could be cultivated in this country.

It is true that mankind have lived, and could live, without the use of silk, and the same might be said of almost all our luxuries ; but whoever has witnessed the steady progress of refinement in manners and customs which has attended the increase of luxuries in society will be careful how he speaks against the use of an article which gives employment to many thousands of people in its first production, and furnishes many hundreds of thousands with food and raiment by its final manufacture, and has already become one of the most important sources of national wealth. Besides, were it not for the use of silk and its costliness, it is probable that our woolen, cotton, and linen stuffs would be much dearer than they are, and much harder for poor people to obtain. Silk stuffs are, moreover, an appendage of rank and office, without which insignificant courts, ignorant ambassadors, and many other brainless people, would lose their whole splendor and influence.

Silk has always been an expensive article, and has a curious history. It was once valued at its weight in gold at Rome. The extravagant Julius Cæsar covered the stage of the theatre with a silken carpet ; but the Emperor Tiberius prohibited gentlemen from wearing silk dresses, because he considered it effeminate. The emperors Caligula and

Heliogabalus dressed themselves throughout in silk; but Aurelian was so impolite and so penurious that he refused even his empress a robe of silk on account of its costliness.

Kirby and Spence, in their "Introduction to Entomology," mention that "James the First, King of Scotland, was forced to beg of the Earl of Mar the loan of a pair of silk stockings to appear in before the English ambassador, enforcing his request with the cogent appeal, 'For ye would not, sure, that your king should appear as a scrub before strangers.'"

Aristotle, in the third century B.C., and Pliny, in the first century A.D., both speak of the use of silk.

The ancient Greeks and Romans procured their silk from Persia, in which country silk-worms have been raised from the remotest antiquity. And when I saw the great number of wild silk-worms in Cachetia, Imeritia, Mingrelia, Georgia, Shirvan, and Dagestan (the modern provinces of ancient Media), as far as to the heights of the Caucasus, near Tiflis, the idea occurred to me that the fabulous story of the golden fleece of the Argonauts must have had its origin or reference to that rich silk country. These beautiful provinces are now in the possession of Russia, and are called Transcaucasia, and they, with the Crimea, form the richest and most productive countries of the Russian empire.

These Elysian fields induced my friend Castellas, of Paris, now deceased, to settle in Tiflis, and, encouraged by the Emperor Nicholas in 1826, to erect large establishments for the cultivation of silk in Tiflis, Karaback, Shirvan, Noukha, and Imeritia, of which he showed me the plans when I was there in 1825. In these vast establishments he employed twenty-seven thousand hands, including eight hundred Italian men and women; and in the first year of their operation 1,200,000 pounds of fine floss-silk were produced and sold, which, valued at four dollars per pound,

amounts to four millions eight hundred thousand dollars. Mr. Castellás presented me with several bundles of the silk which he manufactured, and it was pronounced far superior in quality to the French or Italian silk by every connoisseur to whom I showed it afterward in my travels through Germany and France.

That enterprising and excellent man died two years after I left the Crimea, and while I was in St. Domingo, and my deep grief at his untimely departure and my loss were only assuaged by the sweet hope of once more meeting him beyond the grave. He has left this world forever, and his grand and extensive establishments have probably perished from neglect; for a country where 1,200,000 idle soldiers rule the inhabitants with a rod of iron, and suck their life-blood, can not well or long succeed in such enterprises.

It seems to me a matter of regret, and a great deficiency in our views of political economy, that the people of the United States of America have not been more persevering and successful in raising their own silk, for the importation of which they pay so many millions of dollars annually. It is true that a few individuals here and there are occupied in this lucrative branch of industry; and I was happy to be able to purchase some fine silk handkerchiefs at Rapp's Economy, eighteen miles below Pittsburgh, on the Ohio, which were manufactured there out of silk of their own raising. But this is like a drop of water to the vast ocean, in a country of so immense an area, and of a population that will soon reach fifty millions. It is not a visionary project, or a *Morus Multicaulis* speculation, that I would encourage; but if our government would protect this branch of industry by a suitable tariff, the cultivation of silk-worms and the manufacture of silk could be made a profitable business. Families in the Middle States of the Union might thus employ many old and infirm men and women, as well as children when not in school; and in the

Southern States could do the same with negro children, as well as with the old men and women who have become incapacitated for hard work.

To plant a large number of white mulberry-trees, for the purpose of raising silk-worms, is neither difficult nor expensive, and whoever raises a large quantity of cocoons may be sure of a ready cash sale of them, and at a great profit.

All the silk and silk-stuffs of commerce originate from the common silk-worm; but there exist several other species of nocturnal lepidoptera in America and in Asia, which produce silk of a different kind, of which no use, or a very limited one, is made; as, for instance, that of the *Bombyx madrono*, mentioned in Humboldt's travels, which is found in the province of Mechoacau, in Mexico, at the height of 10,500 feet above the level of the sea. Handkerchiefs are manufactured of this silk by the inhabitants of Oaxaca.

The cocoons of the large North American Moths, *Cecropia*, *Luna*, *Polyphemus*, and *Promethea*, which I shall illustrate hereafter, contain much silk, a single fibre of which is at least ten times as thick as one of the common silk-worm—an experiment I have often made myself. Stuffs made out of this silk would far exceed the common fabrics in strength and durability, and could not, probably, be worn out in many years.

In India silk is also obtained from the cocoons of other Moths, in relation to which Kirby and Spence say: "Of these, the most important species known are the Tusseh and Arindy Silk-worms. These insects are both natives of Bengal. The first (*Attacus papilio*, Linn.), feeds upon the leaves of the jujube-tree, or Byer of the Hindoos, and upon the *Terminalia alata glabra*, Roxb., the Asseen of the Hindoos, and is found in such abundance as from time immemorial to have afforded a constant supply of a very durable, coarse, dark-colored silk, which is woven into a cloth called Tusseh-doothies. This fabric is much worn by the Brah-

mins and other sects, and would be highly useful to the inhabitants of many parts of America and the south of Europe, where a light and cool, and at the same time a cheap and durable dress, such as this silk furnishes, is much wanted. The durability of this silk is really astonishing, as after constant use for nine or ten years it does not show the least appearance of wear or decay. The insects which make this silk are thought by the natives of so much consequence that they guard them by day to preserve them from crows and other birds, and by night from the bats. The second, the Arindy Silk-worm (*Phalæna Cynthia*, Drury), feeds solely on the leaves of the Palma Christi, and produces remarkably soft cocoons, the silk of which is so delicate and flossy that it is impracticable to wind it off, like other silk, from the cocoons; it is, therefore, spun like cotton, and the thread thus manufactured is woven into a coarse kind of white cloth of a loose texture, but of still more incredible durability than the other, the lifetime of one person being seldom sufficient to wear out a garment made of it. It is used not only for clothing, but for packing fine cloths. Some manufacturers in England to whom the silk was shown seemed to think that it could there be made into shawls equal to any received from India.

The silk which is the most extensively manufactured in China, Japan, France, Italy, and some other countries, is, as already mentioned, the product of the common silk-worm moth, which is of medium size, and of a white, yellowish color. A single female produces from three to five hundred eggs, which are oval, bright yellow, and which may be preserved in a cool room during a whole winter. In the month of May their color becomes lighter or paler, and little white and transparent caterpillars may be seen issuing from them. These little creatures require to be fed immediately with tender leaves of the white mulberry. They will also eat the leaves of maple, pear, and oak trees, as

well as those of the raspberry and wild rose, though only for a short time; but if they eat the leaves of the grape-vine they will die in convulsions within two days.

These tender caterpillars require to be treated with the greatest care. They can not be taken up with the fingers and placed upon the leaves, but must be moved with a fine paint-brush, or with the soft feather of a partridge or quail. Fresh and perfectly dry leaves must be given them twice a day, spread out in a sieve, from which they are to be removed in the same manner—that is, taken up on a feather every time they are fed. All the excrements and remnants of old leaves must be removed, and the sieve made thoroughly clean, before fresh leaves are placed on it, because any accumulation of filth will soon cause them to sicken and die.

These little beings, as soon as they issue from the egg, are able to spin, and may be seen marking their way by a fine silk thread. In ten or eleven days after birth they cast their skin, and this operation is again repeated three times, about as often as every two weeks. When they have cast their skin the third time they are usually grown to one and a half inches in length, at which period of their lives they are subject to diarrhoea and other diseases, caused by dampness, coarse food, cold or bad air. Besides, they have many enemies from which they are in danger, such as mice, moles, weasels, lizards, ichneumon, wasps, hornets, dragon-flies, and even spiders. The apartments where silk-worms are raised must therefore be airy, but dry and clean, and the windows protected by gauze to prevent the entrance of noxious insects.

After they have cast their skin the fourth time their color becomes more yellowish, and they will be observed wandering about uneasily, as if seeking some place to alight, when some brush should be put near them, upon which they may creep and there spin their cocoons.

These cocoons are of a white or yellow color, and con-

tain the chrysalis, which, if allowed to remain undisturbed for two or three weeks, will be metamorphosed into a moth. But the moth, in escaping from its silky prison, breaks the threads of silk which encompass it, and of course renders the cocoon useless to man. Hence, in order to prevent this, the cocoons must be put into a warm oven, where the chrysalis will be suffocated, and then the cocoons may be preserved for any length of time, and their silk reeled off at pleasure.

So easy and amusing is this process, it is surprising that young people living in our country villages, especially where there are white mulberry-trees (and they may be cultivated in almost any of our States), do not more often engage in it. Nothing would be easier than to raise silk enough every year for domestic use, and also enough for sale, from the proceeds of which each individual might realize a handsome salary. But to say nothing of pecuniary advantage, the ennobling nature of the employment—tracing in the natural history of these little animals man's own destiny, and reading so plainly the invariable order of nature which is the foundation of his hopes for the future—one would think, ought to be ample compensation for all the care their culture requires, certainly a sufficient remuneration for so many otherwise idle or misspent hours. To see the successive transformations of these little caterpillars—to watch their development from the tiny egg to their full growth, and then, instead of gradually decaying into death and corruption, as human beings do, to see them in full maturity climbing off the earth, weaving joyously their silken shroud, and calmly folding themselves up, not to die, but only to exchange a crawling body for a winged and ethereal form—what scene in nature more elevating, more consoling, more full of promise to man, the most miserable of all animal creations, and yet the most capable of the highest happiness!

In hopes of encouraging the young to engage in this

lucrative amusement, as well as for the purpose of furnishing accurate data to those who are interested in the history of the raising of silk-worms for commercial purposes, we shall enter still more into its details.

An ounce of the eggs of the silk-worm moth contains about forty thousand caterpillars, which, if all live, will produce one hundred pounds of floss-silk. This number of caterpillars will consume about a thousand pounds of leaves, to furnish which about sixty white mulberry-trees will be required. If these trees are properly cultivated they should be planted about six feet apart, and after they are well grown need very little care.

From these data it may be seen how easy and how profitable is this species of husbandry; and yet so little silk has hitherto been produced in the United States that we have imported it from Italy, France, and China. It seems almost incredible, but it is nevertheless true, that during the year 1855 over twenty-five millions of dollars' worth of silk was imported into this country from the above-named places. We give the exact figures of the imports, viz.:

Of raw silk.....	\$751,628
Of manufactured silk.....	24,916,856
Making in all	<u>\$25,667,979</u>

Italy, scarcely larger than our State of Florida, exports annually raw silk to the amount of \$500,000, and manufactured silk to the amount of \$13,800,000; making in all, for this one article of commerce, \$14,300,000.

Even in the small peninsula of the Crimea, silk-culture is carried on to a very great extent, and in many places by the Tartars, Greeks, and Armenians. We recollect making a July excursion in that romantic country thirty years ago, and our visit to one of the numerous silk establishments there is still treasured up among the delightful incidents of early travels. Before the break of day we left Sudak, on the shore of the Black Sea, directing our way toward the

city of Kaffa, now called Theodosia, a name given to it by the modern northern Semiramis, Catharine II., in honor of Julian's profligate empress. As we neared the city, the high-soaring larks and the melodious nightingales, from the topmost branches of the trees, were warbling their morning salutations to the rising sun, whose crimson beams had just begun to gild the neighboring hills with purple and gold, brightening till their illuminated tops seemed like golden crowns hovering over the heads of Julian and his Empress Theodosia. The contrasts of scenery and of character—Julian, the apostate and enemy of Christianity, and Theodosia, once a prostitute, now a fanatic and an empress—were absorbing all our thoughts, when we came upon a comfortable-looking country residence, on all sides surrounded with white mulberry-trees. Supposing, of course, that these were cultivated for the purpose of raising silk, we could not forbear alighting from the horse and seeking the acquaintance of the proprietor. The estate belonged to an Armenian gentleman, who very kindly received us, and showed us his whole plantation. There were about 800 mulberry-trees upon an area of 300 square yards, and the multitude of silk-worms in their several airy apartments were just on the point of making their cocoons. The net profit of this one establishment for the year previous was 1200 rubles, equivalent to \$240, and the proprietor informed us that he had several other similar ones in different places.

All these peaceful establishments in the Crimea—the home and the happiness of so many families, the support of thousands of harmless and virtuous men, women, and children—have been destroyed in the late pestilential war, and the inhabitants plundered, driven away, or cruelly murdered, and all merely to satisfy the ambition and add to the glory and power of tyrants. Strange that the tortured nations of Europe can submit to the oppressive yoke of tyranny which crushes them! Passing strange that they do

not see that their standing armies are supported only to keep them in perpetual slavery, and that in abolishing their system of hired soldiery they would, at the same time, insure the death of tyrants, and bring the resurrection-day of the oppressed nations!

Many years ago England adopted a ruinous policy in raising immoderately high the duties upon imported raw silk, thinking thus to enforce its domestic production; but the stoppage of all the silk manufactories was the only result. James I. was very solicitous to introduce the breeding of silk-worms into England, and, in a speech from the throne, he earnestly recommended his subjects to plant mulberry-trees for this purpose; but the project was a total failure. That country does not seem to be well adapted to this species of husbandry, on account of the great prevalence of blighting east winds during the months of April and May, when the young worms require a plentiful supply of mulberry-leaves. The manufacture of silk goods, however, made great progress during that king's reign; and it had become so considerable in London, that the silk-throwsters of the city and suburbs formed themselves into a corporation, and in 1661 they employed forty thousand persons. The revocation of the Edict of Nantes in 1685 by the fanatic libertine Louis XIV., who expelled all the Protestants from France to gain divine absolution for his crimes, contributed in a remarkable manner to the increase of the English silk trade by the introduction of a large colony of skillful French weavers, who settled in Spitalfields. The great silk-throwing mill erected at Derby, in 1719, also served to promote the extension of this branch of manufacture; for soon afterward, in the year 1730, the English silk goods were sold at a higher price in Italy than those made by the Italians.

But a great revolution was effected in this manufacture in 1825. Previously to that epoch the legislative enact-

ments in regard to it were the most contradictory and impolitic that can well be imagined. The importation of foreign manufactured silks was prohibited under the severest penalties; but the advantage that this prohibition was so erroneously believed to confer upon the manufacturer, would, under any circumstances, have been more than neutralized by the imposition of oppressive duties on the raw material. This mistaken policy was productive of great injury, because, owing to the exorbitant duties on the raw material, and the want of improvement in the manufacture, the price of silks was maintained so high as to restrict the demand for them within comparatively narrow limits. In 1825, however, a more reasonable policy was adopted, which was soon productive of great change in this department of business. The duties on the raw material were greatly lowered, at the same time that foreign silk goods were allowed as imports on the payment of a duty of 30 per cent. ad valorem. This new tariff was vehemently opposed at the outset, and it was confidently predicted that it would occasion the ruin of the manufacture; but the result has shown the soundness of the principle on which it was based. The manufacturers were now for the first time compelled to call in all the resources of science and ingenuity to their aid, and the result has been that the manufacture of silks has been improved more during the last twenty-five years than it had been during the whole previous century, and that it has continued progressively to increase. The total quantity of raw silk imported for home consumption in 1838 was 3,595,816 lbs. The total number of individuals directly engaged in its manufacture has been estimated at upward of 207,000, and the value of the silks annually manufactured may be estimated at from fifty to sixty million dollars. For full particulars as to the history and manufacture of silk the reader is referred to Porter's treatise on this subject in *Lardner's Cyclopædia*.

About twenty years ago the business of raising silk-worms was extensively introduced throughout the United States, and was entered into with great enthusiasm, but so foolishly, and with so little knowledge of the subject, that the *Morus Multicaulis* speculation proved an entire failure, and caused almost an abandonment of this branch of industry. The changeable temperature of the Northern, Eastern, and Middle States renders them naturally less suitable for the cultivation of the white mulberry, at the time when its leaves are most needed for the young silk-worms, than the Southern States, and, besides, manual labor costs more in the North than in the South, where all the work of a silk establishment may be performed by superannuated or very young slaves, no physical strength being necessary for superintending the silk-worms or for unwinding their cocoons. Since the *Morus Multicaulis* fever died away, however, very few silk-worms have been raised in this country, as may be seen from the *Statistical View of the United States*, by J. D. B. De Bow, Superintendent of the United States Census, Washington, 1854; from which I copy the following table:

SILK COCOON PRODUCTION OF THE UNITED STATES IN 1840 AND 1850.

States.	1840.	1850.	States.	1840.	1850.
	Pounds.	Pounds.		Pounds.	Pounds.
Alabama.....	1,592	167	Mississippi	91	2
Arkansas	98	38	Missouri	70	186
Columbia, Dist. of	651	.....	New Hampshire ..	119	191
Connecticut.....	17,538	328	New Jersey	1,966	23
Delaware.....	1,758	.....	New York	1,735	1,744
Florida.....	124	6	North Carolina....	3,014	229
Georgia	2,292	813	Ohio.....	4,317	1,552
Illinois	1,150	47	Pennsylvania	7,262	285
Indiana	379	387	Rhode Island	1,013	468
Iowa.....	.....	246	South Carolina....	2,080	123
Kentucky.....	737	1,281	Tennessee.....	1,217	1,329
Louisiana	317	29	Texas .....	.....	28
Maine.....	211	252	Vermont.....	4,286	268
Maryland.....	2,299	39	Virginia	3,191	317
Massachusetts.....	1,741	7	Total sum....	60,811	10,603
Michigan.....	268	108			

From this statistical table it will be seen that the decrease of raised silk-cocoons in this country amounts to 50,208 pounds; but at the same time we perceive with pleasure that they were rather increasing in the State of New York, and still more in Maine, Indiana, and Tennessee. In Kentucky, also, according to the last census, 544 pounds of silk-cocoons were produced more than at the date of the preceding census.

But our limits will not allow us longer to dwell upon the history and rearing of the Silk-worm, and we pass to the consideration of its caterpillars, only referring our readers for more complete details to the most modern and perhaps the best work on the subject, viz., that of Count Dandolo, of Venice: "*Dell' arte di governare i bachi da setta. Milano, 1819.*"

The Cecropia, Polypheme, Luna, and Promethea Moths.

This noble family of large Moths is, perhaps, the handsomest of all the nocturnal lepidoptera. They are beautifully covered with soft down, and are ornamented with a great variety of splendid colors. -It seems, at first view, strange that colors so beautiful should be found on insects that display themselves only at night; but it is not, after all, in dissonance with the poetry of Nature that they should be seen sporting only in the calm, starry night, on the soft breezes that are laden with delicious fragrance, when the fire-flies glisten on the earth like the reflection of twinkling stars on the bosom of the placid water, and the mysterious whip-poor-will or the lugubrious owl whistle their melancholy music through the sombre forest. Often have we roamed through Nature's open temple till the blazing sun had gone to rest; and, overcome with the day's fatigue, have laid us down amidst the fragrance of wild flowers, only to dream of things the day could not reveal. Thus in the depths of slumber have we often laid, and in dreamy

Figure 31.



The Cecropia Moth.

visions seen the graves of the dead all open, and spirits ascending in the shape and winged dress of these nocturnal insects, sporting in the moonlit space, dancing to the never-ceasing fiddle of the merry cricket, stooping down to the dewy earth, with bended heads close by our attentive ears, as if to confess the evil and the misery of a former life, then joyfully shaking off the mist, and darting upward into the purer ether.

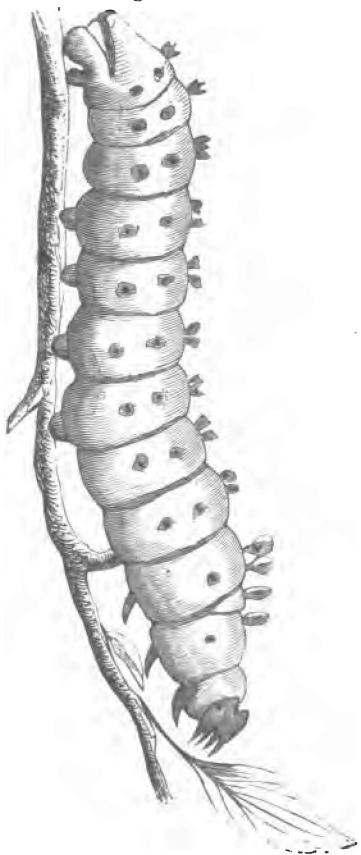
One of the handsomest of these nocturnal fairy-like insects is the CECROPIA MOTH (*Attacus cecropia*), Fig. 31. It is found all the way from the Canadas down to the Mexican Gulf, as well as in all the Western States. We have received specimens from Montreal and from Louisiana, and some very fine ones from Davenport, in Iowa, sent by our esteemed entomological correspondent, Professor D. S. Sheldon, of Iowa College.

This beautiful Moth has very large wings, which, when expanded, will measure from five to six inches in breadth, and which are covered with dusky-brown feathered scales, and adorned with a kidney-shaped red spot and a reddish-white band, with a black spot resembling an eye upon the upper or fore wings. It appears in the Southern States as early as the month of May, but in the Northern not until June, when the female deposits her white, kidney-shaped eggs upon the apple, cherry, or wild plum trees, the leaves of which constitute the food of the caterpillars, which are hatched out of the eggs by the warmth of the atmosphere.

The Caterpillar, Fig. 32, is almost as beautiful as the perfect insect. It measures from three to four inches in length, is of a light-green color, and has coral-red warts, with short black bristles covering its body. It remains upon the trees, feeding on its leaves, till August or September, when it descends, and may often be seen creeping on paths and sidewalks, searching for currant or barberry bushes, upon which it likes to build its cocoon.

Any one who meets with these caterpillars in the above-

Figure 32.



Caterpillar of the *Cecropia*.

mentioned months may have the pleasure of witnessing their metamorphosis into cocoons, and several months afterward into an elegant Moth, by taking them up very carefully upon leaves and cautiously carrying them home, placing them in a spacious box, with a little moistened earth at the bottom, and then putting into it some dry brush-wood, about one foot high, and covering the whole with gauze in order to prevent their escape. On the first and second days of their captivity they will run unsteadily from one part of the box to another, ascending and descending, examining every part of it in order to choose the most convenient spot for spinning their cocoon, in which

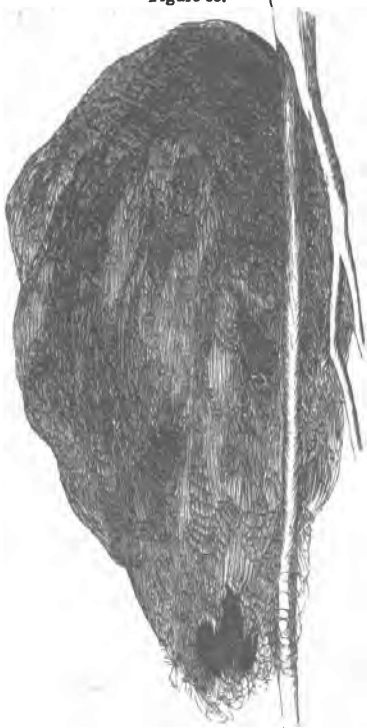
the chrysalis is secured from the inclemency of the damp and cold weather, and lies safer than an infant in its cradle. In less than two days they spin, between two twigs of the brush, a brown, parchment-like cocoon, three inches long and one

wide, which is fastened securely to the twigs, and which is so strong that its outer coat can not be torn with the fingers. The inside of this outer skin or covering is thickly lined with soft but strong brown silk, which may be woven and unwound like that of any Silk-worm, and surrounds a black, shining chrysalis, from which in due time the Moth issues.

Fig. 33 represents the cocoon, and Fig. 34 its silk.

These cocoons remain motionless on the bushes until May or June, and though often exposed in the open air to a temperature as low as 10° Fahr. they are perfectly protected. Those which we have raised in the house come out as early as April, because the warmth of the room develops them sooner. When ready to emerge from its shell, the Moth throws out a caustic liquid from its mouth, which destroys the fibres of silk and enables it easily to pierce the upper end of its parchment-like prison, from which it then creeps out with short, damp antennæ and wings, which by continual moving become dry and enlarged to their natural size.

Figure 33.



Cocoon of the Cecropia.

Figure 34.



Silk of the Cecropia.

In the "Philosophical Transactions of the Royal Society of London," for the year 1759, vol. li., p. 54, it is stated that the Rev. Samuel Pullein was among the first to attempt to unwind the cocoons of the Cecropia Moth. "Mr. Pullein ascertained that twenty threads of this silk, twisted together, would sus-

tain nearly one ounce more in weight than the same number of common silk.

We find also, in the "Transactions of the American Philosophical Society of Philadelphia," vol. i., p. 294, that Moses Bartram, of Philadelphia, as early as the year 1767, raised a number of caterpillars from the eggs of the Cecropia, from which he obtained cocoons.

"About twenty years ago," says the *Journal des Débats*, Paris, Juillet, 1846, "Mons. Audouin received a box of cocoons of the Cecropia and its kindred moths from New Orleans, and he succeeded perfectly in raising them, and afterward witnessing their several metamorphoses."

The Polypheme, Luna, and Promethea Moths also produce large cocoons, and silk of the same quality; and our lamented friend, Dr. Thaddeus Harris, of Cambridge, Massachusetts, says, in his Treatise on Injurious Insects: "The following circumstances seem particularly to recommend these indigenous Silk-worms to the attention of persons interested in the silk culture. Our native trees afford an abundance of food for the caterpillars; their cocoons are

much heavier than those of the Silk-worm, and will yield a greater quantity of silk; and as the insects remain unchanged in the chrysalis state from September to June, the cocoons may be kept for unwinding at any leisure time during the winter. The Luna, Polypheme, Cecropia, and Prometheus Moths are the only native insects belonging to the genus *Attacus* known to me. Their large cocoons, consisting entirely of silk, the fibres of which far surpass those of the Silk-worm in strength, might be employed in the formation of fabrics similar to those manufactured in India from the cocoons of the Tusseh and Arindi Silk-worms, the durability of which is such that a garment of Tusseh-silk is scarcely worn out in the lifetime of one person, but often descends from mother to daughter; and even the covers of palanquins made of it, though exposed to the influence of the weather, last many years. Experiments have been made with the silk of the Cecropia, which has been carded and spun, and woven into stockings that wash like linen."

With all these facts before us, however, the raising of Silk-worms for the production of silk in this country has never yet been a flourishing branch of industry, nor are we able to foresee the time when it will become so.

Another large silk-producing Moth is the **POLYPHEME MOTH** (*Attacus Polyphemus*), Fig. 35. Its name, derived from one of the giants of mythology, Linnæus gave to this Moth probably on account of the large size of its wings, which, like those of the Cecropia, expand from three to six inches. They are of an ochre-yellow color, clouded with black, and each wing is ornamented with a transparent spot resembling an eye. The caterpillar of this Moth is found in July or August, according to the geographical latitude, on oak, elm, and lime trees, and is from two to three inches long, and nearly as thick as a man's thumb. Its body is pale, bluish green, covered with orange-colored and purple warts. Its head and feet are black. When full grown, it

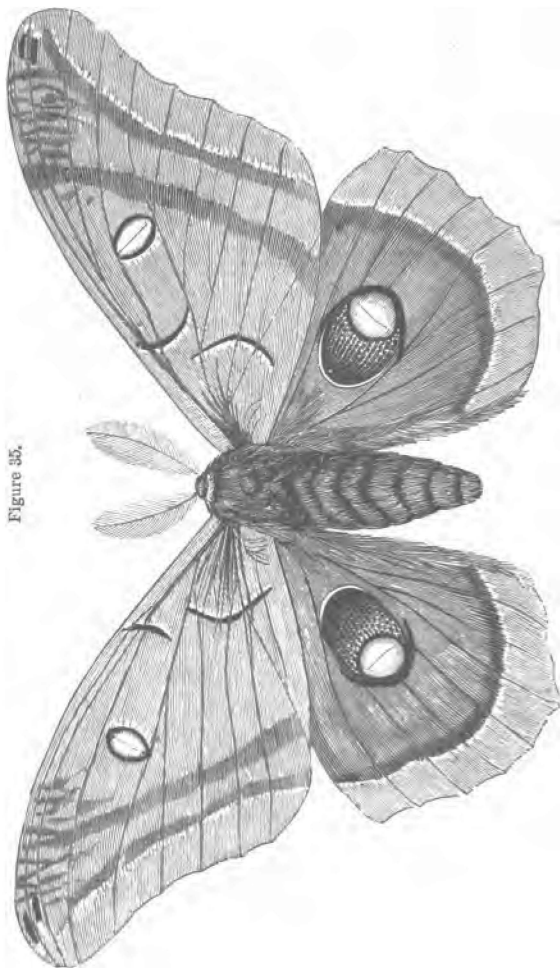


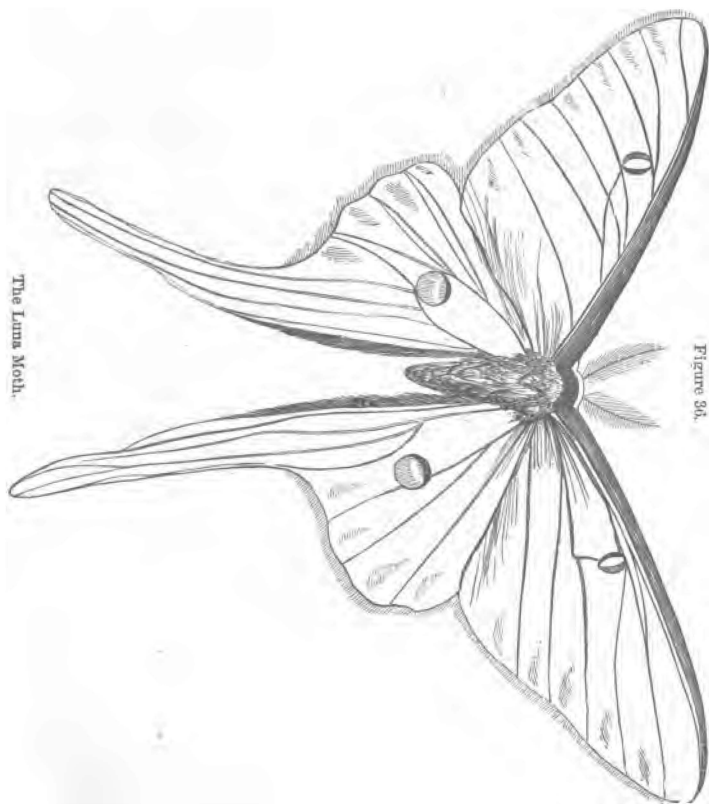
Figure 35.

The Polyphemus Moth.

draws together several leaves of the tree with its silken thread, and, inclosed within them, manufactures an oval cocoon about two inches long, which is very strong, con-

tains much silk, and, toward winter, falls to the ground with the dry leaves. There it remains until the following July or August, when the perfect moth issues from its damp prison, having spent the whole of the cold season uninjured under deep snow or on the moist ground. The cocoons of this Moth, producing silk of the same quality and in the same quantity as those of the Cecropia, may be found, in the spring, under oak, elm, or lime trees.

The LUNA MOTH (*Attacus Luna*), Fig. 36, has wings of



The Luna Moth.

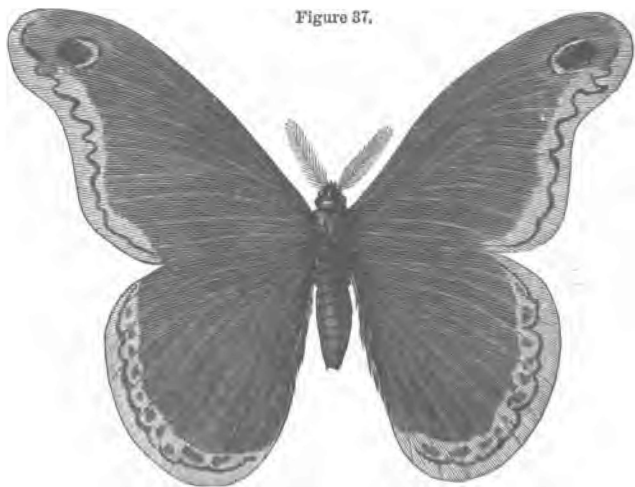
Figure 36.

a beautiful light-green color, prolonged behind in the form of a tail. They also expand from three to five inches.

The caterpillar of this moth, resembling almost exactly that of the Polypheme in size and color, lives on walnut and hickory trees, and manufactures its cocoon in the same manner. At the approach of cold weather these cocoons also fall to the ground with the leaves of trees, and those who wish can gather them in the fall or spring. Their silk, also, is of the same quality as that of the Cecropia and Polypheme Moths.

The PROMETHEA MOTH (*Attacus Promethea*), Fig. 37, the

Figure 37.



The Promethea Moth—Male.

male, and Fig. 38, the female. As is often the case with beasts, birds, and other insects, the male of this moth differs very much from the female in colors. The male insect is of a dark brown, and the female of a light reddish-brown color. Both are ornamented with a black spot, somewhat like an eye in shape, upon the fore wings, and the female

has, besides, an angular reddish-white spot near the middle of each of the wings. The wings of both expand from three to four inches.

The female deposits her eggs, according to the geograph-

The Prometheus Moth.—Female.



Figure 38.

ical latitude of the country, in June or July, generally upon the twigs of sassafras-trees, and in several clusters, which are hatched in about three weeks. The caterpillar, before its metamorphosis, measures about two and a half inches. It is of a bluish-green color, with the exception of the head,

feet, and tail, which are yellow. Upon its body are often seen several small wart-like eminences, some of a coral red, others of a dark blue color.

A larva of this kind, before making its cocoon, glues a leaf to the twig on which it rests, in order that it may not fall to the ground in autumn, and in order to use it as a cover to its cocoon, which is only about one inch long, of an oval form, and contains good strong silk, though not as much as the others of this genus of *Attaci*. These cocoons may easily be collected every autumn or winter upon the twigs of the sassafras-tree, when all the leaves have fallen off except those upon which these insects have fastened.

The above moths are the four species of native insects from the cocoons of which durable and strong silk stuffs may be fabricated; viz. :

The <i>Cecropia</i> ,	found upon	apple, cherry, or plum trees;
" <i>Polypheme</i> ,	" "	" oak, elm, or lime trees;
" <i>Luna</i> ,	" "	" walnut or hickory trees;
" <i>Promethea</i> ,	" "	" sassafras-trees.

These nocturnal beauties are probably the most useful of all of their order to man, and, not being to any extent injurious to vegetation, their abundance in any country should be considered as one of the resources of wealth and luxury. But we pass to others, if not as useful, yet quite as beautiful.*

The Beautiful Deiopeia (Deiopeia bella).

This little creature, although classed among the nocturnal lepidoptera, on account of her bristle-formed antennæ, is,

* My friend, Mr. John Akhurst, the distinguished taxidermist of Brooklyn, raises with the greatest facility at his house, from the eggs, many hundreds of these useful moths, and shows, by doing so, the practicability of making in this country from our native insects durable silk stuffs, which could form a new and extensive branch of American industry and commerce. He feeds the caterpillar of *Cecropia*, *Luna*, *Polypheme*, and *Promethea* on the leaves of the sweet gum-tree (*Liquidambar styraciflua*).

nevertheless, seen flying about from morning until evening, displaying her beauty to delight the eye of man throughout the day, or floating joyously with her fellows upon the sable wing of night. Her elegant dress proclaims her one of Nature's high nobility. It is not a sixpenny or shilling calico, the livery of servitude; nor even a French calico, the dress of the modest middle-class in easy circumstances; but she is clothed with the most gorgeous silken apparel, of which no Miss of our most fashionable boarding-schools, nor even the most dashing and cunning coquette in Paris, would be ashamed.

Figure 39.



The Beautiful Delopea.

This moth has fore wings of a deep yellow color, spotted with black; while its hind wings are scarlet, bordered with a trimming resembling black lace. The wings expand about one and a half inches. The body is white and covered with black dots.

Like all of Nature's beauties, this insect makes its home among the flowers. Throughout the summer and early autumn months, along the banks of almost all our inland streams, where grow the golden lilies and white Solomon's-seals, the sweet-scented roses and blue lupina, with yellow wood-sorrels and azure forget-me-not's, this little moth may generally be seen flying from blossom to blossom, living on their nectared sweets, and dying only to leave its future offspring there.

Its caterpillar usually lives upon the plant called in Europe Forget-me-not (*Myosotis arvensis*), which grows every where on the banks of springs and brooks, and, presented to a young lady in either France or Germany, is considered "*une declaration d'amour*;" but in America this plant is known by the name of scorpion-grass.

This little butterfly, some would say, is of no use to man. Its splendid costume and graceful motions only delight the eye for a transient moment, and even while we admire there hovers in the air a rapacious dragon-fly, which pounces upon its beautiful form and destroys it at once. "*Sic transit gloria mundi!*" the moralist exclaims—thus vanishes all of glory in the world! So passed away the beautiful Mary, Queen of Scots, the lovely Anne Boleyn, and Marie Antoinette, Queen of France, falling from the climax of splendor into a cruel and ignominious death! So vanishes all that's beautiful, and of what use is it? The meteor sparkles and is gone, the flower blooms and fades away, the lightning's flash illumines heaven for a moment, and then only leaves "the dark more darkling."

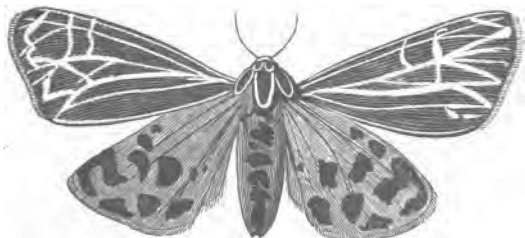
True, but the impress of the beautiful, like that of the good, is never lost upon the human mind. The most striking instances of manly courage, of female devotion, of heroic fortitude, of intellectual greatness, have been concentrated in the work of transient moments, and those moments have become moments of supernatural power; like electric currents, their effects have spread through never-ending human circles. Magic words have reverberated through successive generations, and their eloquence been as deeply felt ages after their first utterance. The ocean's unfathomed depth and the starry heaven's unlimited space have in every age proclaimed Nature's supremacy over man. A brute sees nothing of the beautiful, he but feels the control of a superior speaking through his master's eye; but man, whose destiny is immortal, learns, from transient glimpses of the beautiful in nature, the perfection of taste and feeling to which his spirit must attain as he travels onward through eternal spheres. Who, then, will despise the winged beauty that flits before his gaze, or pronounce that useless which a Father's hand hath made?

The Woolly Bears (Arctia).

The Woolly Bear is the name of the next genus to which we shall call attention, and of which we shall mention a few conspicuous species. A great number of caterpillars which are metamorphosed into moths are thickly covered with hairs, and in some fanciful respects resemble bears. On this account they have been called Woolly Bears, and the whole genus is named *Arctia*, from the Greek word *ἄρκτος*, which signifies a bear. Their moths, however, are known by the name of Tiger Moths as well as Ermine Moths.

The VIRGIN TIGER MOTH (*Arctia virgo*), Fig. 40, is one

Figure 40.



The Virgin Tiger Moth.

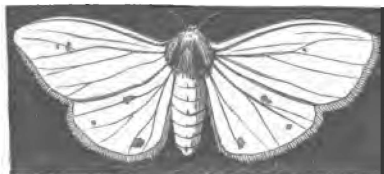
of the handsomest and largest of this genus, but on account of its fetid odor it is very disagreeable to handle. Its fore wings expand more than two inches, and are of a pale flesh-red color, covered with black stripes and spots, while its hind wings are vermillion red, with a row of black dots around them.

Its caterpillar is thickly covered with brown hairs, and may be seen, in the months of July and August, creeping upon the paths, and feeding upon all kinds of grass, until it makes its hairy cocoon in the crevices of some wall or fence.

The **ARGO TIGER MOTH** (*Arctia Argo*) is a little different from the preceding: it is smaller and not so highly colored. Its caterpillar is of a very dark-green color, and is seen in large numbers during the autumn, running on paths and feeding upon grasses, but principally on the plantain. It forms a coarse, hairy cocoon, in the same manner as the former, in crevices.

The **WHITE MILLER**, or **VIRGINIA ERMINE MOTH** (*Arctia Virginica*), Fig. 41, is

Figure 41.



The White Miller.

considered quite a handsome moth. It may be seen early in the summer, flying short distances in meadows and gardens during the day

and in the evenings. It is generally white, though sometimes of a yellowish color, with a black spot near the centre of the fore wings and two black spots on the hind wings. The wings expand about one and a half inches. The eggs, which the female deposits on the leaves of different herbaceous plants, are of a golden yellow color, and from them issue caterpillars, which are thickly covered with hairs more or less yellow, and which on this account are called Yellow Bears. They become about two inches long, and feed on every herb which comes in their way. The leaves of Indian corn are their favorite food, but they eat also those of clover, peas, beans, and cabbages. They are, therefore, injurious to vegetation, and ought to be destroyed whenever met.

The RUSTY VAPOR MOTH.—This moth, also called **TUSOCK MOTH** (*Orgyia leucostigma*), Fig. 42, is neither distinguished for its beauty nor its size. Its wings expand only about an inch, and are of a light-brown color, of very ordinary and uninteresting appearance. But its caterpillar

(Fig. 43) is quite handsome, and is seen during the summer,

Figure 42.



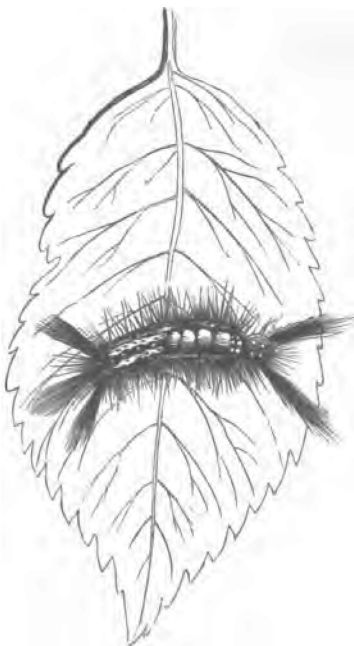
The Rusty Vapor Moth.

generally on rose-bushes or on apple-trees. Its slender body, about one inch long, is covered with long, fine, yellow hairs, and is ornamented at each extremity with two brush-like, yellowish tufts, while its head is as red as sealing-wax. The motions of these cater-

pillars are very slow, and they eat but very little; but if they are numerous on apple-trees, they injure them by spinning their cocoons upon the leaves, fastening their eggs upon them, and so destroying the vitality of the tree.

Great caution should be used in handling these caterpillars, as its hairs sting like nettles. When full grown they spin their tender cocoons upon a leaf, from which the perfect moth issues in less than two weeks. The female moth, however, is wingless, and deposits her eggs upon her own empty cocoon, which she then covers with a white fluid substance, which, when dry, becomes scaly and brittle.

Figure 43.



Caterpillar of Rusty Vapor Moth.

H

The Tent-caterpillars.

It is interesting to notice how various principles and habits of mankind are illustrated in the different phases of insect life. So very striking are some of these coincidences that we can not avoid the inference that the social customs of society were originally borrowed directly from Nature, and that there was a time when man and beast alike followed only Nature's teaching. The more artificial become our habits and customs, the farther removed they are from the purity and simplicity of nature, and the more dependent upon a conceited and hollow-hearted hypocrisy.

Among the insects we have already noticed some of the monarchs and aristocrats, the tyrants and the brain-feeders. Now we come to a peaceful working class, bound together by a community of interest, and all laboring together for the common good. The Tent-caterpillars are the purest Socialists in the entomological world, and there is more of pleasure to be derived from a perusal of their history than from that of many a country and nation of the old continent; because the latter is so filled up with the disgusting biographies of vile despots, their crimes and wholesale murders, that the mind revolts from its contemplation. But in the history of this insect tribe we see something that reminds us of our own free country, of the mutual dependence of the States, and of the common interests that makes us "*E pluribus unum.*" God grant that motto may ever float upon her banners and be engraved upon the hearts of her people! that as her history has been, so it may ever be, the purest and the brightest in the Book of Nations, because the truest to those principles of charity and benevolence which even dumb nature teaches us are the best calculated to produce general happiness and prosperity! that as we have now witnessed how union and harmony augment even the smallest things, "*Concordia res parvæ crescunt,*" we may

never experience how soon disunion and discord destroy the greatest, "*Discordia maximæ dilabuntur.*"

The AMERICAN TENT-CATERPILLAR (*Clisiocampa Americana*) is a small insect that makes its abode principally upon the apple and wild-cherry tree. As soon as these trees are clothed with the first tender leaves of spring we may observe upon some of the twigs, or smaller shoots from the main trunk, a small angular web, or tent, like a spider's web, and if this be examined we shall find it containing some three or four hundred very small caterpillars. These feed upon the leaves of the tree, and in proportion as they grow larger in size their tent increases in circumference. These caterpillars increase in numbers very fast, and if they are not destroyed as soon as first discovered they will quickly cover all the branches, and in fact the whole tree, with their web-like tents, which will each be filled with large families, the offspring of one mother. Many thousands of these individuals live upon one tree in social companies, all working together in the manufacture of their water-proof habitations, sleeping together at night securely, for their tents are entirely impervious to any kind of moisture, and coming out regularly twice a day to take their meals, unless it rains, which makes a day of fasting for them.

These caterpillars all issue from eggs which are deposited and glued around the twigs of the tree by their mother during the preceding summer. The eggs laid by one single female generally exceed three hundred in number.

The head of this caterpillar is black; its body is whitish, lined with black and yellow stripes, and clothed with a few soft hairs. It attains its growth in about seven weeks, and then is nearly two inches long. Toward the latter part of June they make their cocoons in crevices, and about three weeks afterward are metamorphosed into moths, which are of a reddish-brown color, having wings which expand one and a half inches.

This moth was called by the late Dr. Harris, of Cambridge, *Clisiocampa Americana*, and belongs strictly to the nocturnal lepidoptera. It is often seen in large numbers, during the month of July, entering our rooms in the evening, flying around the light, and often being punished for its temerity by burning its wings and body. In the same month its female deposits her eggs upon a tree, gluing them with a gummy, water-proof substance around the extremity of some branch, and leaving them, during the whole autumn and winter, exposed to the inclemency of rain, frost, and snow, without the slightest injury.

Early in the spring, however, the caterpillars begin to issue, full of life and vitality, and immediately commence erecting their tents in unison with several families of the same species, and, if not at once destroyed, very soon surround a whole tree, and for seven or eight weeks devour its leaves, until all its verdure and fruit is destroyed, and its vitality—at least for the season—ruined. In this way large orchards of the finest apple-trees fall to decay before the ravages of this little caterpillar.

In order to avoid this, and get rid of such pernicious insects, we must destroy their eggs and caterpillars. We must examine our apple-trees in the month of December, or after the foliage has fallen to the ground, and crush all the eggs which we find at the extremities of the branches. We must look again in April and May, and destroy their webs as soon as they are formed, and kill their caterpillars, reaching those upon the highest branches with a long pole, at the end of which should be fastened a sponge or rag moistened with soapsuds or whitewash. If this be turned around and through the web it will bring it, with the caterpillars, to the ground, when they can easily be killed.

To be effectual, this operation must be done at seven or eight o'clock in the morning, or at noon, when all the caterpillars are in their tents; for they are very regular in

their habits, and can easily be found at home, as they all go out to their meals regularly at nine A.M., then return toward mid-day, and go out again at three o'clock P.M., and return as soon as they have eaten. This destructive insect is found in all parts of the Union, and people having gardens or orchards should be careful to prevent its ravages by destroying it in season.

The WOOD-TENT CATERPILLAR (*Clisiocampa sylvatica*) is another not less noxious insect, gaining its own livelihood in the same destructive manner upon walnut and oak trees, although it is not unfrequently found also upon apple and cherry trees. When full grown, in June, it is about two inches long. Its head and body are light blue, and its sides somewhat of a greenish color. It makes its cocoon and webs in the same manner as the preceding ones, and sometimes destroys whole orchards and large tracts of forests.

The moths are of a dark-brown color, and its wings expand about one and a half inches.

The webs of these two species of caterpillars are made of the finest silk, and if properly collected and spun it could be manufactured into fine silk stockings or gloves—a profitable amusement for the ladies spending the summer in the country.

Span-worms.

The Span-worms are little caterpillars, very injurious to vegetation, but quite harmless to man, although they are very annoying to all who walk through our orchards or parks during the month of June, by swinging against the face as they hang on the silken thread by which they let themselves down to the ground from the trees. The parks and promenades of our large cities—New York, Philadelphia, Boston, etc.—abound with them, and they really afford a serious inconvenience to promenaders, and not unfrequently cause considerable fear to the timid upon whom

they may alight. They particularly infest these places, because there are so few of the birds there which feed particularly upon them.

But the ravages of these insects are not confined to our shade trees, for they feed also upon the leaves of our fruit trees, as well as of elms, poplar, lime, and other trees. When fully grown they are forced by nature to go to the ground, in order there to undergo their metamorphosis into a cocoon; and as they are not provided with sixteen feet, like other caterpillars, they are very poor pedestrians, and find it much easier to let themselves down to the ground by means of the silken thread which issues from their mouth as they need it. They sometimes descend from a height of more than fifty feet in a few moments, while, if they were obliged to depend upon their ten, or, at most, twelve legs, the journey would occupy them several days.

Caterpillars generally have sixteen legs, or feet, placed at equal distances along the under part of the body; but these have only five or six feet at each extremity, and none under the middle, so that when they walk they stand on the hind feet, and throw their fore feet and body as far ahead as its length will allow; then, standing on their fore feet, they draw up the hind ones to them, making an arch of the footless centre of the body. This process, it is evident, must be slow; and it is probably on account of this singular method of locomotion, which resembles somewhat that of spanning or measuring, that they received from Linnæus the name *Geometræ*, and from other authors the names "Measurers," "Span-worms," and "Tailors."

In the United States we find a great variety of these caterpillars, all of which are in their season metamorphosed into small moths, the most conspicuous of which is:

The CANKER-WORM (*Anisopteryx pometaria*). The caterpillars of this moth are usually hatched from their eggs in the spring, and when very young are of a dark-brown color,

with a yellowish stripe on both sides ; but when fully grown they are about one inch long, and vary in color, some being greenish-yellow, and others green, 'with small black spots upon the back. They are generally found in the most abundance upon apple-trees, but also devour the leaves, buds, and blossoms of plum, cherry, and other fruit trees, as well as those of many ornamental and shade trees.

The Canker-worm has but ten feet, and, on account of its difficult locomotion, is not much disposed to promenade, but, when not occupied at meals, lies stretched out upon a twig, like an Italian or Mexican enjoying the *Dolce far niente*—"the luxury of doing nothing." About the middle of June, or when four weeks old, they usually descend from the tree either by slowly dragging their length along down the trunk, or more commonly by letting themselves down on their silken cord, like a rope-dancer, and enter the ground to the depth of several inches, there to metamorphose into cocoons. In the autumn they issue from the cocoon as perfect moths, the male of which is only provided with wings, of an ash color, which expand about one and a quarter inches. The female is wingless, and is obliged to perform her journey as well as she can on foot to the nearest tree, not one of her numerous male admirers being able to assist her. But in course of time she reaches the tree, climbs up its trunk and branches, and there deposits her eggs in clusters of a hundred or more, which she then fastens to the branch or twig with a firm covering of water-proof varnish. There the eggs remain, perfectly protected from the effects of rain and cold, until the ensuing spring, when the caterpillars are hatched.

The LIME-TREE SPAN-WORM, (*Hibernia tiliaria*) is another kind of caterpillar, abundantly found in the month of June upon lime, poplar, elm, and apple trees, in almost all our parks, woods, and gardens. It is a little larger than the former, being, when full grown, one and a half inches long,

of a light-yellow color, and having a dark-red head. The fore wings of the moth expand one and three quarter inches, and are of a nankeen-yellow color, with very small light-brown dots upon them, while the hind wings are similar, but much paler. The female of this moth is about half an inch long, and, like the other species, has no wings. Their manner of living and time of metamorphosis is about the same with the insect just described, the canker-worm, and their ravages upon the foliage, buds, and blossoms of lime, poplar, and elm trees, are equally ruinous and destructive. Many of these trees, as also some fruit trees, are entirely stripped of their foliage by them, and ultimately destroyed.

The ravages of these two species of insects are so common, and annually do so much injury to the farmer, the gardener, and the horticulturist, that we can not forbear laying before our readers some of the methods for preventing this evil, which we think judicious and effectual, and, rather than to use our own words, we quote from the work of the late Dr. Harris, of Cambridge, Massachusetts, "On the Insects Injurious to Vegetation," Boston, 1852.

He says, page 363, "In order to protect our trees from the ravages of canker-worms, it should be our aim, if possible, to prevent the wingless females from ascending the trees to deposit their eggs. This can be done by the application of tar around the body of the tree, either directly on the bark, as has been the most common practice, or, what is better, over a broad belt of clay mortar, or on strips of old canvas, or of strong paper from six to twelve inches wide, fastened around the trunk with strings. The tar must be applied as early as the first of November, and perhaps in October, and it should be renewed daily as long as the insects continue rising; after which the bands may be removed, and the tar should be entirely scraped from the bark. When all this has been properly and seasonably done, it has proved effectual. The time, labor, and expense at-

tending the use of tar, and the injury it does to the trees, when allowed to run and remain on the bark, have caused many persons to neglect this method, and some to try various modifications of it and other expedients.

“Among the modifications may be mentioned a horizontal and close-fitting collar of boards, fastened around the trunk, and smeared beneath with tar; or, four boards nailed together like a box, without top or bottom, around the base of the tree, to receive the tar on the outside. This can be used to protect a few choice trees in a garden, or around a house, or a public square, but will be found too expensive to be applied to any great extent. Collars of tin-plate fastened around the tree, and sloping downward like an inverted tunnel, have been proposed, upon the supposition that the moths would not be able to creep in an inverted position beneath the smooth and sloping surface. This method will also prove too expensive for general adoption, even should it be found to answer the purpose. A belt of cotton-wool, which it has been thought would entangle the feet of the insects, and thus keep them from ascending the trees, has not proved an effectual bar to them. Little square or circular troughs of tin, or of lead, filled with cheap fish-oil, and placed around the trees, three feet or more above the surface of the ground, with a stuffing of cloth, hay, or seaweed between them and the trunk, have long been used by various persons with good success; and the only objection to them is the cost of the troughs, the difficulty of fixing and keeping them in their places, and the injury suffered by the trees when the oil is washed or blown out, and falls upon the bark. Mr. Jonathan Denis, Jun., of Portsmouth, Rhode Island, has obtained a patent for a circular leaden trough to contain oil, offering some advantages over those that have heretofore been used, although it does not entirely prevent the escape of the oil, and the nails with which it is secured are found to be injurious to the trees.

These troughs ought not to be nailed to the trees, but should be supported by a few wooden wedges driven between them and the trunks. A stuffing of cotton, cloth, or tow should never be used; sea-weed and fine hay, which will not absorb the oil, are much better. Before the troughs are fastened and filled, the body of the tree should be well coated with clay, paint, or whitewash, to absorb the oil that may fall upon it. Care should be taken to renew the oil as often as it escapes, or becomes filled with the insects. These troughs will be found more economical and less troublesome than the application of tar, and may safely be recommended and employed if proper attention is given to the precautions above named. Some persons fasten similar troughs, to contain oil, around the outer sides of an open box, inclosing the base of the tree, and a projecting ledge is nailed on the edge of the box to shed the rain: by this contrivance all danger of hurting the tree with the oil is entirely avoided."

In the *Manchester Guardian*, an English newspaper, of the 4th of November, 1846, is the following article on the use of melted India rubber to prevent insects from climbing up the trees: "At the late meeting of the Entomological Society of London, Mr. J. H. Pennel communicated the following successful mode of preventing insects ascending the trunks of fruit trees: Let a piece of India-rubber be burned over a gallipot, into which it will gradually drop in the condition of a viscid juice, which state, it appears, it will always retain; for Mr. Pennel has at the present time some which has been melted for upward of a year, and has been exposed to all weathers without undergoing the slightest change. Having melted the India rubber, let a piece of cord or worsted be smeared with it, and then tied several times around the trunk. This melted substance is so very sticky that the insects will be prevented, and can be captured, in their attempts to pass over it. About three

penny-worth of India rubber is sufficient for the protection of twenty ordinary-sized fruit trees."

These are about all the directions necessary to give for preventing the ravages of insects injurious to our trees; and, if they are carefully and perseveringly followed out, will be effectual in saving many a fine orchard from desolation and decay. There surely can be no farmer unable to avail himself of some of the simple contrivances mentioned, and thus save his capital and his labor.

The APPLE-WORM (*Carpocapsa pomonella*), which is so often found in apples, pears, plums, and apricots, is a flesh-colored, naked caterpillar, half an inch long when fully grown, with a black head and sixteen feet. It issues from an egg, deposited upon the fruit by its mother in the month of June or July, and as soon as it is hatched works its way through the skin and lives in the fruit about three weeks; then it gnaws its way out, falls to the ground, and, creeping to some retired place, is there metamorphosed into a thin, silky cocoon, from which it issues in a few days as a perfect moth, when it again lays its eggs, from which a second generation arise to mar and destroy our fall and winter apples.

The wings of this moth expand only three quarters of an inch, and are of a light, yellowish-brown color. The fruit which it infects, or upon which it lays its eggs, usually falls to the ground before it is fully ripe, and before the caterpillar hatched from the eggs is ready for its metamorphosis into a cocoon. Hence, in order to destroy them, they may be collected by hanging old clothes about the trees, and the caterpillars will creep into them for the purpose of making their cocoons, or the fruit should be gathered as soon as it falls and boiled up, thus destroying the second generation.

Now this moth, altogether an insignificant-looking affair, is not only capable of doing a vast amount of injury, but it possesses remarkable instinct, or is endowed with wonder-

ful properties of reason and judgment. How many persons who have found a disgusting little worm in an apple have ever thought that they never can find but one in each apple? Yet so it is. How many have ever dreamed that that worm, if allowed to live, would become a moth, and reproduce itself over and over again, and yet among the myriads of such insects there would be deposited but one egg on each fruit? How do other moths know that there is an egg already deposited there, or that there is already a caterpillar within the fruit? How do they know their eggs will not fructify upon ground already occupied by another? Is it instinct or reason teaches them these things, and marks their course with so much accuracy?

Again, look at another phenomenon connected with this wonderful little caterpillar. Cut an apple open that contains one of these inhabitants, and you see the whole quantity of its black, granular excrements tied together by silky filaments, produced by this worm, in order to prevent these minute grains from rolling about and impeding its motions. Is not this contrivance, thought, design? Is it reason or instinct that guides their tiny but wonderful course? Were these little bubbles of foam on Life's great ocean wafted to our barks in vain? Were these animated atoms sent crawling on the choicest fruit that we gather with our hands, or carry to our mouths, to exhibit in their ephemeral existence only a striking illustration of Nature's nice adaptation of means to an end?

Or were they created, solitary preachers on each little globe of fruit, which falls like manna from above, to teach us some great moral lesson? Come they into our very faces to remind us how "dearly we pay for the primal fall?" Do they inhabit the finest specimens of that fruit by which our first mother was tempted, in order to bid us taste the viands of Eden, and make us feel that "the trail of the serpent hangs over them all?"

Truly a worm may teach us many things! 'Tis a little index, but, like the needle to the pole, it points to the hand Divine!

The Bee-moth (Galleria cereana).

The Bee-moth is another wonderful little insect, capable of doing much injury, and possessing curious developments of instinct. It seems scarcely possible that a large army of bees, defended by deadly stings such as they possess, should allow a few small soft-bodied and unarmed caterpillars to enter and destroy their fortified castles. Yet this is the case. Notwithstanding their weakness, and entire lack of means to defend themselves, the larvæ of the bee-moth will enter and so corrode the honey-combs as to force the bees to abandon their hive.

More than two thousand years ago these moths were mentioned by Aristotle, who says of them: They fly in the night toward a light, and are very fond of eating beeswax, for which purpose they go to the bee-hives and there deposit their excrements, out of which proceed little worms. Colomela also declares them to be the most terrible enemies to bees.

The caterpillar of the bee-moth has sixteen feet. Its body is yellowish-white, its head brown, and its length, when fully grown, a little more than an inch. It feeds upon the beeswax, and their tiny insect stomachs will digest what a learned chemist could not analyze. Their life is one of continual exposure to the greatest danger, for woe to the individual that is caught by a bee. They seem to know, however, that they subsist at the expense of a powerful and warlike population who admit no strangers within their republican domain; and as their tender, unprotected skins would be constantly exposed to the fatally-venomous stings of the enraged bees, Nature has taught them to dig a mine in the wax, and thus supply themselves with both

clothing for their naked bodies, food for their sustenance, and a safe dwelling at the same time.

The excavated passage which this caterpillar makes in the wax is generally as large round as a man's finger, and often a foot long; the inside of it is thoroughly tapestried with a strong, but soft and smooth, white silky substance, and the outside is covered over with pieces of wax mixed with excrements, so that nothing is seen of the silken passage, and the bees have no idea of its existence. Even if they had cognizance of it, they would be unable to sting through such thick walls and penetrate the firm silky lining of the passage.

In order to learn the habits, and watch closely the operations of these injurious insects, we may select a hive which has been abandoned by bees, or where the bees have died during the winter. By taking out some of these larvæ and putting them upon the comb, we shall see that, after running about a while, they will begin to dig a new mine, or, if it is their time, to spin a cocoon one inch long, which they will immediately surround with dirt and small pieces of wax. They generally make their cocoons in the beginning of the month of June, and the moths then issue from them at the end of the same month.

The male of this moth has gray fore wings, and yellowish-gray hind wings. He is smaller than the female, whose wings are darker, particularly the hind ones, and expand about one and a quarter inches. Unfortunately, both are seen in abundance early in May, as well as in August, and hence we may conclude that there are two successive generations of them in one year. The female deposits her eggs at that time of night when the bees are at rest, and near the opening of the hive, or in some adjacent cracks, and as soon as the diminutive caterpillars are hatched they immediately gnaw a passage under its edges.

There is still another way of observing minutely their

operations, the result of which is very surprising. Place some of these caterpillars, or moths, in a large glass vessel covered with gauze, and provide them with a certain quantity of beeswax as food, and after the wax is consumed they will eat paper, dried leaves, and even woolen cloth, but only after they have eaten, digested, and several times re-eaten their excrements, which after many digestions will be reduced to a black dust, from which they afterward fabricate tunnels. In this manner they will go through their various metamorphoses, multiplying for several years in the glass vessel, without requiring any care or new supply of food.

These moths are not natives of America, but, like the bees upon whose products they live, were originally foreign emigrants from Europe. But as the bees, in spite of their foreign origin, and the venomous sting they bring with them to defend themselves against their assailants, have, by their great practical utility and long residence here, become naturalized citizens, so we may reckon the moths and their caterpillars as among our own injurious insects, which deserve to be destroyed by any means in our power.

In Dr. Thatcher's "Treatise on the Management of Bees," there are several ways mentioned by which we may get rid of this pest of the bee-hive. But the most convenient and least troublesome method of preventing the bee-moth from entering the hive is to place shallow basins, filled with water mixed with vinegar, and sweetened with honey, sugar, or molasses, near the entrance to the bee-hive, and this should be done early in the evening, as soon as the bees have gone to rest. This, too, is the time when the bee-moths are flying about seeking a place to deposit their eggs, and as they are very fond of sweets, a great number of them will be drowned.

The Grain-worm ; or, White Corn-worm (Tinea cerealella).

This is another very injurious insect, also originally an emigrant from the Old World.

Grain is devoured, as is well known, by different species of larvæ, some of which are metamorphosed into snout-beetles, as the Rice-weevil, or Black Corn-worm (*Calandra granaria*) ; others into flies, as the Hessian-fly (*Cecidomyia destructor*), or the wheat-fly (*Cecidomyia tritici*). These, of course, can only be mentioned incidentally here, as we are treating of moths, and must continue the natural history of the Grain-moth.

The female of this species is very active in the months of May and June, when she comes out of neglected granaries ; and, flying about with her male attendant at night, she deposits her eggs upon the grains of wheat, barley, rye, and oats. From these eggs, in a short time, proceed diminutive, yellowish-white, naked caterpillars, with a brown head, which immediately commence their devastations among the grain. With a silky thread they fasten together several grains, and between them make numerous holes or passages in which they can securely reside. By so doing the little animal has built for itself a very comfortable, and even substantial dwelling ; for if it should roll down the grain-heap or be tossed about in a cart, its body is still inclosed in a soft fold of silk, and would not suffer at all. Here they feed upon the mealy substance of the grain for about three weeks, when they arrive at maturity, at which period they are about the fifth part of an inch long. Then, changing into a chrysalis within the empty grain, they are soon transformed into small, winged moths of a cinnamon-brown color. Two successive generations of this insect are developed every year.

The French naturalist, M. Bosc, who spent several years in the United States, in 1796 found this moth so abundant

in Carolina that they would extinguish the flame of a candle when he went into a granary with one at night. And Dr. Harris says: "The grain-moth has spread from North Carolina and Virginia, where its depredations were first observed, into Kentucky and the southern parts between the thirty-sixth and fortieth degrees of north latitude. But these are not the extreme limits of its occasional depredations, as it has been found even in New England, where, however, its propagation seems to have been limited by the length and severity of the winters."

Some of our distinguished agriculturists have written very valuable papers upon this destructive insect, to which those who choose can refer; *e. g.*, Edwin Ruffin, Esq., of Hanover county, Virginia, published in the *Farmer's Register*, for November, 1833. Mr. Samuel Judah, of Vincennes, Indiana, in the *Indiana Farmer and Gardener*, for October, 1845. Mr. Richard Owen, of New Harmony, Indiana, in the *Cultivator*, for July and November, 1846. E. Ruffin, Esq., in the *American Agriculturist*, for February and March, 1847.

It would be altogether too tedious to our readers to enter into the minute and various methods of destroying these insects and preventing their ravages, proposed and practiced by the above-named gentlemen, and so we only refer to their papers for the sake of those who are curious on the subject. We can only remark in this place that one process has proved effectual in destroying the insect without injuring the grain, according to our own personal observations in those rich grain countries of Hungary, Austrian Galicia, Poland, and Russia, from the Neva, down through the Ukraine as far as the mouth of the Don and Volga, on the Black and Caspian seas. In every village of those countries there are large kilns, or ovens, where the grain is put as soon as it is thrashed out, and during one day or one night is exposed to a temperature of one hundred and sixty

degrees Fahrenheit, by which process all caterpillars in or upon the grain are destroyed, and of course further propagation prevented. Grain brought from the Russian seaports Odessa or Riga always find a ready market for exportation, on account of their excellent quality and general freedom from the ravages of insects. In Germany they sprinkle the floors of their granaries, and even the grain itself, with salt water, and overturn the grain heaps with shovels as often as possible.

The Carpet-moth (Tinea tapetzella).

This is another very small, but very annoying and troublesome moth. It has dark-brown fore wings, and grayish-brown hind wings. It flies around in the beginning of summer, depositing its eggs in carpets, the cloth lining of carriages, and woolen clothes generally. Its eggs are white and round, and in about three weeks from the time they are laid very small caterpillars proceed from them, which are yellowish white, and so transparent that any colored stuff—for instance, scarlet cloth—eaten by them is distinctly visible in their bowels. In the cloth lining of carriages we very often find thread-bare places, which are made by these larvæ, who bite off the woolly nap of the cloth, from which they manufacture a silky cylinder-like cover over their bodies, open at one end, from which they stretch out their head when eating the hair of the wool. They form their cocoons in much the same manner as other moths, and in about two weeks after are again metamorphosed into perfect moths. Beating and brushing all woolen cloths liable to their invasion is generally sufficient to prevent their depredations. A cedar chest is also said to afford entire protection from them for all clothes kept in it, and the same is true if woollens be wrapped up with camphor, or sprinkled with snuff or tobacco when packed away.

But our limits will not allow further notice of these

smaller species, of which there are many more, and we conclude, for the present, our history of the nocturnal lepidoptera with a brief description of a few of

The Sphinxes, or Hawk-moths.

When the summer sun has sunk below the glowing hills, and his last radiant beams are fading from the western horizon; when the red Tanagers, the Cardinal and Blue Birds, and the Orioles and Robins, with all the other gay songsters of the day, have retired to their resting-places amidst the silent groves—then the sleepy Sphinxes awake from their diurnal slumbers, to play out their brief parts on the narrow stage of their ephemeral existence. They rise at twilight, and ramble with the humming sound and the quick, irregular flight of Humming-birds, flying from flower to flower, sucking the sweet nectar of the fragrant night-blossoms and pursuing their bridal sports, while the celestial shepherdess, Luna, is watching her silvery lambs through the blue pastures of heaven.

In ancient times, when Egyptian, Greek, and Roman priests, in concert with despotic rulers, gained their wealth and treasures by frightening the common people with stories of gods and goddesses, of demi-gods and heroes, of Olympus and Tartarus, and by means of a mythological religion, full of mystic symbols and incantations, stupefied the credulous populace, and rendered them subservient to their will, we find, among others, the mythological tale of a monster called the Sphinx, who is represented with the body of a lion and the head and shoulders of a woman, sitting upon the hind feet like a dog.

A fanciful resemblance to this monster was seen by the fertile imagination of Linnæus in the caterpillar of the insects we are about to describe, inasmuch as it has a soft, effeminate-looking body, and when not eating assumes a somewhat similar sitting posture, and hence he called it a

Sphinx. After its last transformation into a winged insect it becomes a Hawk-moth, so called because while sucking the nectar from the cups of flowers it is hovering in the air like a hawk. It is also called by some the Humming-bird Hawk-moth, from the humming sound which it produces with its wings, and by rubbing its horny proboscis upon the small glassy membrane beneath it.

Figure 44.



Five-spotted Hawk-moth.

Most of the hawk-moths are seen only during some hours after sunset, but some smaller genera are also seen flying about during the day. Notwithstanding this, Linnæus calls them all evening butterflies.

The POTATO-WORM HAWK-MOTH, or FIVE-SPOTTED SPHINX (*Sphinx quinque-maculatus*), Fig. 44, is a large green caterpillar, with oblique white stripes on each side; when full grown, it is more than three inches long. It is found not only on the potato-vine, but also on the tomato and egg plants; and it also feeds upon the leaves of every species of the *solanum*, or night-shade tribe. Here it is found from July to September, when it digs its winter retreat several inches below the surface of the ground, and there metamorphoses itself into a brown chrysalis, upon which may be distinctly seen the long case of its proboscis, resembling somewhat the handle of a pitcher.

The Five-spotted Hawk-moth issues from this chrysalis in May or June. It is of a grayish color, and its body is ornamented with five orange-colored spots on each side. Its wings expand nearly five inches. Its head is provided with two cylindrical antennæ, and a proboscis or tongue, which is almost entirely concealed when not in use, but which can be unrolled, like the spring of a watch, to the length of five or six inches. This proboscis consists of two parts, which can easily be separated, but which, when united together as usual, forms a hollow tube, through which the animal is enabled to suck the nectar of flowers, and with which it also produces a humming sound by rubbing it upon the diminutive glassy membrane at its base.

There is no insect that possesses a voice; and when we hear sounds produced by insects, we may know that they originate from friction of some external parts of the body, as is the case, for instance, with some of the Capricorn beetles, who rub the joints of the head against the thorax; or with grasshoppers, who produce a sound by bringing

their spiny legs in contact with their wings; or with crickets, by rubbing their wings together; and with flies and the different species of bees, who make a noise by the rapid motion of their wings.

Among many others we have every year attempted to raise a number of these handsome caterpillars, but have often been unsuccessful in bringing them to their final metamorphosis, because, as soon as they were full grown, they ceased to take food, became sick, and died. In such cases we have noticed the surface of their bodies completely covered with small, shining, white silky-looking grains, resembling minute seeds, and if one fell off its place was immediately supplied by another. These white specks were the silky cocoons of diminutive ichneumon-flies, whose mother had stung the poor caterpillar when very young, and deposited many hundreds of eggs in as many hundred wounds. The larvæ proceeding from these eggs dwell between the skin and the fat of the caterpillar, on which they feed, being very careful not to attack any vital part of the body. Thus the unfortunate caterpillar is for several weeks being slowly devoured, while it continues to eat and to grow for the benefit of its tormentors, until all its fat is consumed by these parasites, when, having no strength or vitality left with which to accomplish its metamorphosis, it lingers along a few days, shrinks to the fourth part of its former size, and finally dies in agony. Then the small cocoons of the ichneumon-flies fall to the ground, and a few days after assume their perfect form, and fly about, after the example of their mothers, to seek new victims.

While on the subject of Hawk-moths, we can not omit a brief incidental notice of one species, which is a native of the southern parts of Europe, because even now it spreads a general terror among the ignorant and superstitious. And we do this the more willingly, because many Ameri-

can travelers are constantly visiting the transatlantic countries, and may meet with this beautiful but much maligned insect.

It is a large Hawk-moth, with yellow wings variegated with black, and on the thorax it bears a mark which somewhat resembles a human skull—on which account it is called the **DEATH'S-HEAD HAWK-MOTH**. It first attracted attention during the prevalence of a severe and fatal epidemic, and of course nothing more was necessary than its appearance at such a time to induce an ignorant people to believe it the veritable prophet and forerunner of death. A curate in Bretagne, France, made a most horrible and fear-exciting description of this animal, describing the very loud and dreadful sound which it emitted as a sort of lamentation for the awful calamity which was coming on the earth.

This is but another proof that, were the great mass of the people better educated in Entomology, they would escape much imposition, and avoid much imaginary suffering, and much real but unnecessary fear of the harmless creatures around them. This moth has no mouth to bite with, and is no more injurious to vegetation than the others of its species. The sound it produces is very much like that made by mice, but has a more pitiful tone, and is much louder, if you put it in a box or hold it between your fingers. Any one may determine the origin of the sound, however, by uncoiling its proboscis and stretching it out with a pin, when all sound ceases at once; but let the animal coil up its proboscis again, and it immediately commences rubbing it against the glassy membrane beneath it, and the sound begins again.

The caterpillar of this moth, when full grown, is about four inches long, of a yellowish color with black spots, and oblique green stripes upon each side, and is found principally, in the month of July, in England on the jasmine; in

Germany on the potato-vine; and in France, Egypt, and Asia, on the thorn-apple (*Datura stramonium*).

There are several species of hawk-moth caterpillars found upon our garden and forest trees, on grape-vines and other shrubs, which are quite injurious to vegetation, but which can be easily seen on account of their large size, and destroyed without much trouble, or they may be secured in boxes for the purpose of raising their beautiful moths. One of these injurious insects is the caterpillar of

The **FOUR-HORNED SPHINX** (*Ceratomia quadricornis*), Fig.



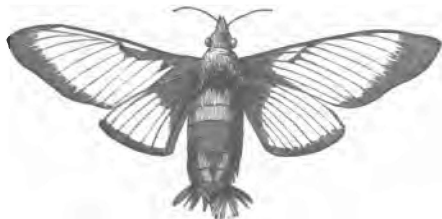
Four-horned Sphinx.

45, which is generally found, in the month of July, upon our lime, poplar, and especially elm-trees, which are frequently stripped entirely of their foliage by its ravages. The beauty of this caterpillar universally attracts attention, its body being of a light-green color, with oblique white lines upon each side, and ornamented with four notched, short horns on the shoulders. When full grown it is about three inches long. It soon enters the ground, changes into a chrysalis, and makes its appearance as a perfect hawk-moth during the

following summer, having remained in the ground during the whole winter and spring. The moth, however, is not as handsome as its caterpillar, having wings of a light-brown color, variegated with white and dark brown, and expanding from four to five inches.

The HUMMING-BIRD, or TRANSPARENT-WINGED SPHINX

Figure 46.



Humming-bird Sphinx.

(*Sesia Pelasgus*), Fig. 46, also belongs to the large family of Sphinxes, but is distinguished by its transparent wings, fan-shaped tail, and by its appearance during the day, hovering over flowers like a humming-bird. It is very handsome, and is frequently seen, in our flower-gardens, during the months of July and August. Its metamorphoses and habits of life are much the same as those of others of the same genus.

The SATELLITIA (*Philampelus satellitia*) is another very handsome Sphinx, the moth having wings of a light olive color, which expand from four to five inches.

It is called *Philampelus* (Lover of the Vine), because its caterpillar feeds principally on the grape-vine, where it is found devouring the leaves, during the months of July and August. This larva is more than three inches long when at maturity, of a pale-green color, and ornamented with six cream-colored spots on each of its sides. Like all the others, it descends into the ground, transforms itself into a cocoon, which lies dormant during the winter, and from

which proceeds the perfect hawk-moth in the following summer.

These are some of the beauties as well as the monsters of the night. Now let us see whether the day will reveal any thing more perfect or more beautiful.

Butterflies (Lepidoptera diurna).

These beautiful, light-winged fairies possess one great advantage over the moths; viz.: they are born to flourish in the light, to adorn the brightest day, and to grow only more resplendent in the dazzling beams of the noonday sun. Of all the rich and sparkling colors that shine in Flora's variegated summer dress, there are none more brilliant, none that attract the eye so like flashes of unearthly light, as those with which Nature has adorned these fitting life-beams of the day. It has passed into a moral axiom that those human characters which can bear the most open scrutiny are the truest and the purest, while it is only the evil who shun the light; and so, in our ordinary appreciation of the beautiful, that which will bear the strongest light without exhibiting imperfection is considered the most perfect.

Besides, the diurnal butterflies are surrounded with scenes and circumstances calculated to make them more attractive than any others. They are not only more seen and noticed in the day, but they appear at a season and time when the summer's warmth and genial breath expands all hearts, and draws out even the sick from their close and gloomy chambers to admire the beauties of earth and air, and to partake of the vivifying and gladdening influences which Nature sheds around. Then they come, like winged messengers from the spheres of love and beauty, flitting from flower to flower, basking in the sunshine, joyously providing for their future offspring; and then not lingering along to die in the winter of a desolate life, but, amidst all the

illusions of youth and happiness, being actually “rocked to sleep in a cradle of flowers.”

For these reasons the butterflies have always been admired more than any other insect, and have attracted universal attention from every people, and in every clime where they have been found. Especially are they the favorites of the youth; so much so, that in some countries—as, for instance, Germany and France—almost every town has its youthful amateurs who collect and exhibit them in glass cases. In China and the Indies these collections form a part of their exports, which generally meet with a ready sale. The pencil and the brush of many a distinguished artist has been occupied with them; and there are now in existence a greater number of splendid works, descriptive and illustrative of them, than any other class of animals can boast.

For the sake of our readers who desire to investigate these works, we refer to a few of the best, which are beautifully illustrated with well-colored and generally accurate engravings.

ROESEL'S *Insecten Belustigung* (Amusements with the Insects).

MERIAN, *Insecta Surinamensis*.

DRURY'S *Exotic Insects*.

ESPER'S *Europäische Schmetterlinge* (European Butterflies).

ESPER'S *Ausländische Schmetterlinge* (Exotic Butterflies).

ERNST et ENGRAMELLE, *Papillons d'Europe*.

HERBST'S *Schmetterlinge* (Butterflies).

HÜBNER'S *Schmetterlinge* (Butterflies).

DONNOVAN'S *Insects of China, India, and New Holland*.

ABBOT'S *Natural History of the Insects of Georgia*.

BOISDUVAL et LECONTE, *Lépidoptères de l'Amerique Septentrionale*.

THOMAS SAY'S *American Entomology*.

Notwithstanding the beauty of the butterflies, and their apparently happy life, they are extremely selfish in their habits, and on this account their faculties seem very limited in comparison with other insects. We never find them united in democratic republics, like the ants; or in a consti-

tutional monarchy, like the bees; nor in a socialistic monster phalanstery, like the paper-manufacturing wasps; but they are real anarchists, the subject of no superior officer, and of no kind of government. Every one takes care of himself; and in this fact, perhaps, lies the great secret of their happiness; for, although they are deprived of all social comforts, still no one can find fault with another where all mind their own business, and are mutually independent. This social condition would never answer for mankind, because from our nature we are mutually dependent upon one another, and ever must be so; but it does very well for the short-lived butterflies, who require but little food and have no trouble to procure it. Independently they ramble about while the sun shines, and during the night they sleep upon the trunk or branches of a tree, or on the under side of a leaf, of which they take fast hold with their feet.

Butterflies, like moths, are not directly injurious to vegetation, because they have no mouths with which to eat, but only a proboscis through which they suck the sweet juices of flowers. Their caterpillars, however, are equally rapacious, and would destroy all our vegetables, as well as trees, if their number was not constantly diminished by birds, beetles, wasps, lizzards, frogs, toads, and other animals that feed upon them.

Neither butterflies nor their caterpillars have ever been used as articles of food by man, although the ancient Roman epicures considered the flesh of some grubs—for instance, those of the Stag-beetle—as a very fine relish, and among the inhabitants of the tropics in America the palm-worm is very commonly eaten. Drury, an English entomologist, recommends all persons who are cast by shipwreck on desolate islands, and can not find any thing else to eat, to seek for those grubs which feed on wood and are found in the trunks of trees, and says they can comfortably subsist on them, at least for a short time.

Butterflies originate from eggs, in the same manner as moths, and like them go through the metamorphosis, first into caterpillars, then into cocoons, and lastly into the perfect butterfly. They are, however, distinguished from the moths by their short and knobbed antennæ, very short and imperfect fore feet, and by their flying about only in the daytime. They have four wings, ornamented with the same never-ending variety of colors as their nocturnal relations, while gold and silver, with azure and purple velvet, is lavished upon them with profusion. The illustrious Linnaeus, who was a scholar of very extensive and varied attainments, was almost a worshiper of these beautiful insects, and bestowed upon them the names of gods and goddesses, of heroes and kings, and many very romantic names borrowed from ancient history and mythology. So we find among the butterflies a *Priamus*, *Hector*, *Ulysses*, *Ajax*, *Apollo*, *Iris*, *Io*, *Protesilaus*, *Achilles*, *Nestor*, *Menelaus*, *Paris*, *Anchyses*, *Polydamas*, *Helena*, *Remus*, *Æneas*, *Danaus*, *Heliconia*, *Atalanta*, *Argus*, etc.

These names were all given for some fancied resemblance in look or character, and although at first sight they may appear irrelevant and pedantic, yet they have done much to enrich entomology as a science, by ingrafting upon it, through the power of association, so much other and interesting knowledge. We will relate one anecdote in illustration of the manner in which this fanciful and oftentimes inappropriate technology has really enriched the science, and added to its general usefulness as a study.

While traveling in Russian Poland thirty-six years ago, we visited the highly-accomplished Countess Ragowska, at her country residence, when she exhibited her fine, scientifically-arranged collection of butterflies and other insects, and told us that she had personally instructed her children in botany, history, and geography by means of her entomological cabinet. To convince us of the truth of her assertion,

she sent for her little daughter, and requested me to question her on the subject, at the same time bidding the child to tell us what she knew about the insects in the cabinet. That little child, only eleven years old, very modestly addressed us in French, saying, "You see, Sir, many butterflies and moths in this cabinet, of which shall I tell you what I know about them?" We asked her what she knew about a certain magnificent butterfly, which glistened in one of the boxes like polished silver, covered with the most beautiful ultramarine color. She replied: "That handsome insect is called *Menelaus*, and it is a native of South America: its caterpillar lives on the sapodilla-tree (*Achras sapota*)—a branch of which we have in our Herbarium, but the fruit of which is unknown to me. Oh will you not bring or send me some when you go to America?" And so that interesting child went on, and related to us the history of Menelaus, and the Trojan war, and told us too the history, geography, and natural productions of the country of which the insect was a native; and all this knowledge she had gained, under the guidance of her mother, through that entomological cabinet. When she had finished, her mother said: "Now, Sir, do you not think that even a small cabinet of Natural History furnishes a great amount of knowledge, and for both old and young provides abundant material for entertaining and instructive conversation? As for me," she continued, "I consider this noble science as the philosopher's *Spiritus familiaris*, who snatches the false face from the sophist and the atheist, and makes him believe in, kneel down, and adore the omnipotence of the Almighty."

Our own opinions on this subject have been too often expressed to need repetition here, and we will only add that this accomplished lady is not the only one who has practically proved the value of even the technology of this science, and the great power of association in fixing facts in

the minds of all, both young and old. For this reason, if for no other, would we acknowledge our indebtedness to the great Linnæus, and endeavor, as far as possible, to preserve his scholarly fancies.

According to his arrangement the butterflies are divided into five different families, which contain :

1. KNIGHTS, with prolonged hind wings, resembling the tail of swallows.
2. HELICONIANS, with narrow, oblong fore wings, and short hind wings.
3. DANAIDÆ, with round wings.
4. NYMPHALIDÆ, with denticulated wings.
5. PLEBEIANS, comprising all other small butterflies.

The system of Linnæus, however, has undergone so many changes by different entomologists in France, Germany, and England, that it would be only fatiguing to enumerate and explain all these divisions, even if our limits would allow it. We must, therefore, for the present, rest satisfied with a brief notice of a few of the most conspicuous species of butterflies that abound in North America, particularly those common in the United States.

One of these is the PHILODICE (*Colias philodice*), Fig. 47. It is found abundantly during the whole summer, sucking the juices of flowers, particularly the thistles, or sitting on the surface of mud-puddles, and in every part of the Union, Mexico, and the Antilles. Its caterpillar is green, and is principally found on clover.

The whole genus *Colias* is easily distinguished, being always of a more or less bright-yellow color, with spots, on a black border on the

Figure 47.



The Philodice.

wings, and reddish antennæ. Their caterpillars are generally green and smooth, and are found on the leaves of different species of the pea-tribe (*leguminosæ*).

The *COLIAS EDUSA*, of a yellow color, more or less mixed with green, is less common than the preceding species, but is found in some of the Middle States during spring and fall, and is identical with the *Colias myrmidone* of Europe. Its caterpillar is dark green, with a white line upon each side, and it lives upon clover.

COLIAS CHRYSOTHEME of New York, and *COLIAS CÆSONIA* of the Southern States, are very little different from the former species.

The genus *Melitæa* is distinguished from the preceding by their wings being spotted with red and black colors, so distributed as to make them look like a chess-board. Their caterpillars are covered with short, velvet-like hair.

The *MELITÆA PHAËTON* (Fig. 48) is quite a handsome

Figure 48.



The Phaëton.

butterfly, but is unfortunately very rare. During many excursions in Rhode Island and New York, we have been able to find only a few of this species.

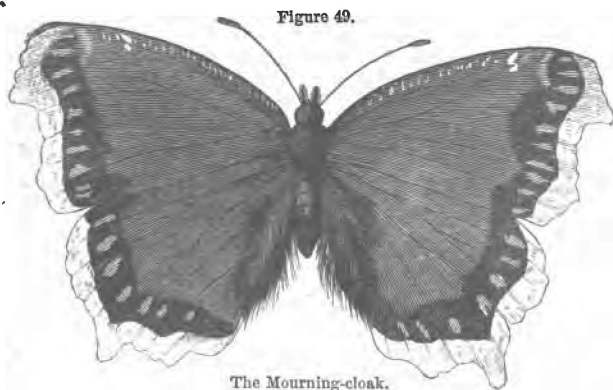
The *MELITÆA THAËROS*, of the Middle, and *MELITÆA ISMERIA*, of the Southern States, are also not very common.

The caterpillars of both genera, *Colias* and *Melitæa*, are both comparatively harmless, and we can not complain of much injury to vegetation being done by them.

The genus *Vanessa* is much more common, and its larvæ much more numerous and rapacious. Its butterflies are distinguished by their velvet-like, denticulated wings, ornamented with bright colors, and their long antennæ. All

their caterpillars are covered with tender bristles, and some species live in large numbers together, as, for instance, those of

The MOURNING-CLOAK (*Vanessa antiopa*), Fig. 49. The



wings of this butterfly are a sort of purplish-black color, dotted with blue spots, and surrounded with a nankeen-colored border. Its caterpillars are also black and thorny, and are frequently seen in large numbers, during the months of May and June, on our birch, poplar, elm, and several other trees, the foliage of which they entirely destroy, stripping off their leaves until they look like mat-weed. The thorny-looking hairs with which their bodies are covered are not at all venomous, as many have supposed, and they may be handled with impunity; although they are so injurious to our ornamental trees, it is advisable always to kill them, which may easily be done by sprinkling the tree and branches with dilute soap-suds, by means of a hand-engine or otherwise.

As this butterfly produces two broods during one summer, the caterpillars will have to be destroyed twice in a season. When these creatures are fully grown, and nearly

two inches long, they metamorphose into a cocoon, which they suspend on fences or walls. Fortunately a great number of these become the prey of spiders and ichneumon wasps, and for this reason four or five summers will not unfrequently pass by without our seeing many of these insects.

This butterfly is also an inhabitant of Europe and Asia. We have seen plenty of them in Italy, France, Germany, and Russia, as far north as St. Petersburg, as well as in Transcaucasia; but whether the American species are descendants of these, or *vice versa*, or whether Nature originally created one pair in the Eastern Continent and another pair, at the same time, in the Western, we are obliged to confess we do not know. The solution of this important question, therefore, we must leave to the Historical Societies of the present day, who are probably analogically opposed to the opinion of that distinguished philosopher, Humboldt, who says that the origin of the human race from one or several pair can not be found out *a posteriori*, and hence all investigation as to the cradle of the human genus is mythological.*

Thus unforeseen events, which startle most when most unexpected, and which often tell upon the faith or the destiny of people and nations, may sometimes occur, as was the case in France some years ago, when, fifteen years after the death of St. Simon the communist, his pupils and followers paid his tailor's bill, "all tailors in France," says Heine, "began to believe."

The ADMIRAL (*Vanessa Atalanta*), Fig. 50, is another beautiful insect of this genus. It has black, velvet-like

* In respect to this question, see the most elaborate philosophical work of modern times: "*Die Aegyptische, und die Zoroastrische Glaubenslehre als die aeltesten Quellen unserer speculativen Ideen*, von Dr. EDUARD ROETH, *ausserordentlichen Professor der Philocophie an der Universität zu Heidelberg*. Mannheim, 1846."

Figure 50.



The Admiral.

- fore wings, ornamented with scarlet-colored cross-lines and white spots, and black hind wings, with a scarlet border around them. On the under side of the fore wings some singular marks are seen, which resemble the figures 98 or 86, and which have given rise to many superstitious ideas among the ignorant. The female deposits about two hundred eggs, green and oval, upon the leaves or stems of nettles. In about a week these become little caterpillars, which are thorny and black, with bright yellow stripes around the body, and which, when fully grown, are about one and a half inches long. They walk very slowly, but eat much and grow very fast. As soon as they are developed from the egg they begin to spin some of the leaves of the nettle together, and thus build for themselves a comfortable dwelling, which at the same time furnishes them with food. After consuming their abode they roll up another in the same way, and thus are actively engaged during the two short weeks of their existence—for this is all the time allotted them—until, at its expiration, they are fully grown, when they form their cocoons and suspend them from some of the branches. As these caterpillars live mostly upon nettles and other useless weeds, they are not considered as injurious to vegetation. They usually appear

in the month of July, during which they pass through at least three transformations—from the egg to the caterpillar, and then to the pupa, which is brownish gray, with some golden spots. This butterfly is frequently found in Europe, where it is also a native; but there it is called Mars, because some have discovered marks upon the wings which are thought to possess some similarity to certain instruments of war.

The THISTLE BUTTERFLY (*Vanessa cardui*), Fig. 51, some-

Figure 51.



The Thistle Butterfly.

times appears in such large numbers that their larvæ devour not only the leaves, but also the blossoms of the thistle and burdock. As soon as one of these caterpillars issues from the egg it draws the points of two leaves together, fastens them with a silky thread, conceals itself therein, and eats the substance of it, until it attains its growth, which is one and a half inches long, when it is ready to metamorphose into a cocoon, from which the perfect insect proceeds in about two weeks. The whole process of its three transformations occupies only four weeks—as it remains an egg one week, a caterpillar another week, and a cocoon two weeks. Thus three or four generations may appear in one summer. The cocoon is generally of a golden-yellow color,

while the perfect butterfly is adorned with yellowish, red, brown, and black colors, with white spots upon its wings. This *Vanessa* is very common in the United States, and it is also found in large numbers in Asia, Africa, and Europe, where it is commonly called the "Painted Lady."

The GOLDEN C BUTTERFLY (*Vanessa C aureum*), Fig. 52.

Figure 52.



The Golden C Butterfly.

This butterfly derives its name from the golden mark beneath the hind wings similar in form to that of the letter C. It has tawny, orange-colored wings, with brown and black spots, and is seen in almost all of the States of the Union from May until September. Its caterpillar is thorny, of a blackish color, and lives upon lime and elm trees, and upon the hop-vine; and to these is often very injurious. There are a number of other species of the genus *Vanessa* found in this country, but they are described and illustrated in Major Leconte's and Boisduval's work "On the Lepidoptera of North America," and therefore we need only refer to their names in this connection. They are: *Vanessa Progne*, of the Northern and Middle States; *Vanessa J. album* and *Vanessa Milberti*, of Philadelphia; *Vanessa Cænia* and *Vanessa Huntera*, of the Southern States.

The Genus Papilio.

This genus, called by Linnæus *Knights* or *Chevaliers*, comprises mostly large butterflies with broad wings, and generally with a long swallow-like tail at the extremity of the hind wings. Some of these butterflies have red spots, like stars, on the breast, similar to the decorations of sovereigns and princes, as well as of the policemen of New York, one of whom, on account of the star on his blue uniform coat, was once mistaken for his Royal Highness the Elector of Hesse Cassel by a newly-arrived Hessian emigrant, who at once began to revenge himself for past oppressions by attacking the policeman like Don Quixote, the barber, with Mambrino's helmet. Linnæus designated these butterflies by the name of *Trojan Knights*, and those without the red spot he called *Greek Knights*.

Notwithstanding their usual large size and elegant dress they are often seen looking very shabbily; for their colors soon fade, and their wings get torn by their flying through thorny bushes when chased by birds, when they look very much like an old bachelor fop who has dissipated his property, and appears with threadbare clothes—a laughing-stock to all the young girls.

These aerial knights, some would doubtless say, are of no use to man; but the admirer of Nature, as we have before said, never thinks any of her works useless. He can always see in them something that is attractive—nay, that is positively useful—either in the moral lesson they teach or in the practical benefits derived from them, directly or indirectly. Thus these butterflies, although they do not directly minister to the animal wants of man, yet have always so beautified the country with their splendid colors and ethereal forms that any person of soul or sense would find something wanting to complete the beauty of Nature's summer face, did he not see them sporting in our gardens, and

meadows, and forests. He might be even so stupid as not to know what was wanting, and yet he would feel the loss of something to make up its perfection. Besides, these insects are directly useful, or should be made so, as we have before shown, by being one of the best channels through which to imprint upon the minds of the young an indelible impression of many of the most important facts in history, as well as to impart a thorough knowledge of geography, botany, drawing, and painting.

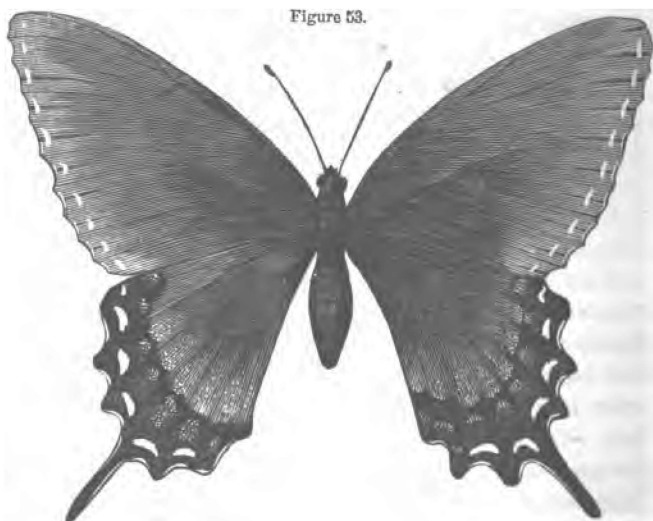
But aside from their moral or intellectual use, the butterflies of this genus, in their caterpillars, furnish an abundant supply of good food for the birds, and the excrements of their caterpillars, when dried and dissolved in water, make a most excellent dye-stuff, like those of the large hawk-moths.

The caterpillars of all the Knights, when touched, thrust forth from their necks a pair of soft, orange-colored horns (*tentacula*), which emit a fetid smell, and are probably designed as a means of defense against the attacks of other animals. These caterpillars are either smooth or furnished with fleshy warts, and they live on several different species of plants. Their metamorphosis into cocoons is accomplished in the same manner as that of the preceding genera. One of the most common of these Knights is

The *ASTERIAS* (*Papilio Asterias*), represented in Fig. 30, with its caterpillar (Fig. 29), is quite large and handsome, and is frequently seen in all parts of the Union during the whole summer. It has black fore wings, bordered with a double row of yellow dots; its hind wings are also black, and have a double row of yellow dots, between which are seven blue spots; and at their lower extremity is a swallow-tail. The *Asterias* always deposits her eggs upon some of the umbelliferous plants, on those whose flower-stalks issue from one common centre, such as carrots, parsnep, celery, coriander, cicuta, anise, fennel, parsley, etc. Hence the cat-

erpillars proceeding from these eggs are very injurious to vegetation ; and it is not uncommon to see more than twenty of them on a single stem of carrot or celery. These larvæ are generally known under the name of Parsley worms, and may easily be destroyed. They are smooth-bodied, and of a bright-green color. These caterpillars may also be collected and raised without trouble, except that many of them are stung by ichneumon wasps, which deposit in each an egg, the maggot of which feeds on the flesh of the caterpillar without touching any vital part or preventing its transformation into a cocoon. After this metamorphosis the maggot consumes all that remains of the embryo butterfly, then goes through its own transformation, and, instead of the butterfly, comes out a perfect ichneumon wasp (Fig. 67).

The TROILUS (*Papilio Troilus*), Fig. 53, is another of these celebrated knights, named by Linnæus after King



The Troilus.

Priam's son, Troilus, who was killed by Anchyses during the Trojan war. This butterfly has black, denticulated wings, spotted with yellow dots, and terminated by a swallow-tail. Its caterpillar is green, with a yellow stripe on each side, and a row of blue dots; while the under side of its body and its feet are of a reddish color. It lives upon the sassafras and spice-wood trees (*Laurus sassafras* and *Laurus benzoin*), and upon several other species of the cinnamon tribe, and is more frequently seen in the Southern than the Northern States, but is very abundant in the Antilles.

The PHILENOR (*Papilio Philenor*), Fig. 54, is much small-

Figure 54.



The Philenor.

er than the former, but like it has black, swallow-tail wings, the black, however, shading into brown and green. Its caterpillar is brown, with two lateral rows of small, reddish protuberances with bristles. It lives on the birthwort (*Aristolochia serpentaria*), and is usually found in the Southern States.

The AJAX (*Papilio Ajax*) was so named by Linnæus, after one of the bravest of the Greek chieftains in the Tro-

jan war. This butterfly is about the same size as the preceding one, and has wings of a brownish-black color, with several white and yellowish stripes, and on the hind wings are yellowish and blue spots. Its body is nearly black, with two white lateral stripes upon it. Its caterpillar is of a pale-green color, embellished with various-colored lines and spots. It is found only in the Southern States, and, with its caterpillar, lives upon the *Porcelia pigmea*, a kind of custard-apple bush, which is by some incorrectly called papaw.

The CALCHAS (*Papilio Calchas*) was so called by the celebrated Danish entomologist Fabricius, after Calchas, the soothsayer and high-priest of the Greek army in the Trojan war. This butterfly is frequently found in the Southern States, from Virginia to Louisiana. It has dark, olive-green wings, crossed in the middle by a yellowish band. Its body is dark, with a longitudinal yellow line on each side, and the whole insect is about the size of the *Asterias*. The caterpillar is green, has red feet, and a yellow hood over its head, and lives on several species of the cinnamon tribe (*laurineæ*).

The POLYDAMAS (*Papilio Polydamas*) was so named by Linnæus, after the Trojan prince Polydamas, son-in-law of the king Priam, and on account of the red spots was classed among the "Trojan knights." It has wings of a dark green or bronze color, on the upper side, crossed in the middle by a yellow stripe, while the under side of the hind wings is of a dark-brown color, with red dots on the margin. The body is black, and has two reddish spots on the neck, which are its insignia of knighthood. Its caterpillar has a light-brown body, with red lines and yellow spots, and lives principally on birth-wort (*Aristolochia serpentaria*). It is found in the South, from Georgia down to South America.

The Genus Danaus.

This is another genus of the *Lepidoptera diurna*, and a large and numerous family of beautiful butterflies. Our limits will not allow us more than to give their general characteristics, and to describe one species, which is very common in this country as elsewhere, and which may be considered a type of the whole. The butterflies of this genus are distinguished from all others by their large, round wings, of a dark-red color, veined with black, and their long, knobbed antennæ. Their caterpillars are smooth, of a cylindrical form, as also is their chrysalis, which is green, ornamented with several golden spots. These insects feed principally upon the poisonous leaves of the different species of milk-weed (*asclepias*), and are found in all countries where these plants grow, which is the case in North and South America, Africa, China, Hindostan, and Australia. One of the handsomest and most common of this genus is

The BERENICE (*Danaus Berenice*), Fig. 55. On account

Figure 55.



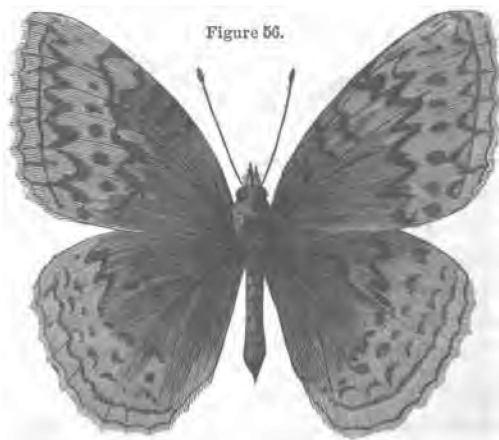
The Berenice.

of its beauty, this butterfly was named Berenice, after the wife of Antiochus, King of Syria, universally considered the loveliest woman of her age. It has dark-red wings, with

black veins, and a black border with two rows of white dots. The body of its caterpillar is of a light violet color, with brown, red, and yellow lines. The chrysalis is round, green, and embellished with golden dots.

The ARGYNNIS is another genus of beautiful butterflies belonging to the diurnal lepidoptera, which we can not omit, although we can give it only a brief notice. A number of its species are natives of North America, and some are common in all parts of the United States. They are all of a yellowish-red color, with black spots on the upper side of their wings, and silvery spots on the under sides. These last so much resemble the mother-of-pearl in their glistening color, that the Germans call the insects Mother-of-Pearl Butterflies. The distribution and forms of these colors, as well as the size of the individuals, constitute the different species. Their caterpillars are cylindrical and thorny, and their chrysalis of an angular form, and ornamented with golden or silvery spots.

One of the most common species of this genus is the IDALIA (*Argynnis Idalia*), Fig. 56. Its fore wings are red



The Idalia.

with black marks, and the hind wings bluish-black on the upper side, while the under sides of all four wings are covered with silver spots. Its caterpillar has a dark-brown body with several yellow lateral lines, and is found in all the States of the Union, sometimes on nettles, raspberries, and willows, but principally on violets.

Boisduval and Major Leconte, in their work, "*Histoire Naturelle des Lepidoptères de l'Amerique Septentrionale*," enumerate, beside the one here described, the following native species, viz.:

Argynnis Diana, of Virginia and Carolina; *Argynnis Cybele*, of the Eastern and Middle States; *Argynnis Columbina*, of the Southern States and Mexico; *Argynnis Myrina*, of the Northern and Southern States; *Argynnis Ossianus*, of Labrador; *Argynnis Polaris* and *Chariclea*, of Labrador and Cape Nord; and *Argynnis Bellona*, of the Northern and Southern States.

ORDER V.

NET-WINGED INSECTS—(NEUROPTERA).

THE insects of this order are distinguished principally by their delicate wings, which resemble the finest network, and on this account they are called by the Germans *Florfliegen* ("Gauze flies"). Their bodies are long, thin, and soft; their wings, also, are long, narrow, and almost transparent. They seem to be in continual motion like swallows, and, catching their prey with their feet while flying, they devour it in the air. They generally deposit their eggs in ponds, in which the larvæ or grubs issuing from them live one or two years, partly on water plants, and partly on other aquatic insects, until they metamorphose into a perfect winged insect, when they change their watery element for a more ethereal one.

All the insects of this order are not only innoxious, but are decidedly beneficial to man, and as such deserve our care and cultivation.

The different genera belonging to this order are quite numerous; and as some of the modern German and French entomologists proposed to unite several of them with the order of Orthoptera, or Straight-winged Insects, our much-lamented friend, Dr. Harris of Cambridge, violently opposed such an innovation, and gave us his reasons for his opposition in the following letter, which, as it so well represents the characteristics of the order we are describing, we shall give nearly entire:

"CAMBRIDGE, MASS., February 22, 1855.

"*Professor Jaeger* :

"DEAR SIR,—Your letter of the 13th January has re-

maintained unanswered longer than it should have been, and I now improve a leisure hour to fulfill this duty.

“Just now, at Professor Agassiz’s request, I have been revising the Neuroptera, and have become much interested therein. Some of the German naturalists (Erichson, etc., etc.) have undertaken to break up this order, leaving therein only those genera which undergo a complete transformation, and have inactive pupæ, such as *Sembris*, *Corydalis*, *Chauliodes*, *Raphidia*, *Mantispa*, *Hemerobius*, *Myrmeleon*, *Ascalaphus*, *Bittacus*, *Panorpa*, and *Phryganea*; and they transfer *Psocus*, *Termes*, *Ephemera*, *Libellula*, *Perla*, etc., to Orthoptera, or put them among the *Blatta*, *Mantes*, *Spectra*, and *Grylli*!

“Linnæus evidently regarded *Libellula* as the type of his order Neuroptera, and this genus seems to have nothing in common with the Orthoptera save a remote resemblance in the structure of the labium and labial palpi, and the imperfect transformation. This transformation, also, is not analogous to that of Orthoptera, excepting only in the fact that the pupæ are active and take food; in other respects they are entirely unlike the perfect insects, whereas the pupæ of the Orthoptera closely resemble the perfect insect, with the exception only of wanting fully-developed wings. Hence I maintain that the *Libelluladæ* can not with any propriety be put among Orthopterous insects.

“*Libellula* is closely connected in organization and habits with other Neuroptera, and hence, if it be retained in this latter order, *Ephemera*, *Perla*, *Termes*, etc., must remain also. My knowledge of these insects, in their various states, is probably equal to that of the Berlin entomologists, and therefore I feel authorized to put my own judgment and experience on the subject against theirs. Without going very deeply into particulars, allow me to contrast the characters of Orthoptera and Neuroptera, thus:

“ORTHOPTERA.—None of them aquatic. All of them active, taking food and growing in the pupa state, which resembles the winged or adult state, except in wanting fully-grown wings. The parts of the mouth well developed; the labial palpi never wanting; the head more or less immersed at the base in the pro-thorax, and possessing only a limited power of motion; antennæ always much longer than the head, often very long, mostly setaceous or filiform, very

rarely pectinated or knobbed; fore wings mostly parchment-like in texture, and wholly unfitted and unused for flight, generally much smaller than the hind wings, and sometimes reduced to very narrow laminæ or entirely wanting (Phasmidæ); hind wings ample, folded longitudinally in many plaits like a fan; pro-thorax, the largest segment of the trunk, often of preposterous size (*Blatta*, *Gryllotalpa*, *Mantis*, *Tetricæ*); abdomen generally provided with articulated setæ, or filiform appendages, and in many with a prominent ovipositor.

"NEUROPTERA.—Many of them aquatic in the larva and pupa states; transformation various, the pupæ of some being quiescent, and in all bearing very little resemblance to the perfect insects; parts of the mouth, in many adult or winged species, rudimentary, soft, and apparently unfitted for taking food; in others they vary in structure, but are often less complete even than those of the larvæ; labial palpi obsolete in some; head generally free, often versatile, and rarely immersed above in the pro-thorax; antennæ sometimes very short (*Ephemera*, *Libelluladæ*), moniliform, filiform, setaceous, pectinated or knobbed at end; fore wings usually as large as or larger than the hind wings, alike to them in texture, and equally fitted and used for flight; hind wings often smaller than the fore wings, sometimes entirely wanting, never folded in numerous plaits when at rest; pro-thorax (except in *Corydalis*, *Raphidia*, and *Mantispa*) the smallest section of the trunk, oftentimes reduced to a mere ring; meso-thorax the largest segment; abdomen sometimes with setaceous appendages.

"The highly reticulated wings of the *Libellulæ*, *Myrmeleontidæ*, and some of the *Perlæ*, which may be regarded as typical genera, together with the varied and mixed nature of the transformations, have always justly been regarded by the most distinguished French and English entomologists as forming the most peculiar characteristics of this order. In the higher instincts and varied economy of many of the Neuroptera we shall find another ground for distinguishing them from the Orthoptera. I need only allude to the labors of the Termites, the artistical skill of the Phryganeadæ in the construction of their habitations, and the faculties and habits of the *Myrmeleontidæ* and *Hemerobiadæ*, with all the various stratagems employed by the

other predaceous tribes of this order, to remind one how far these insects excel the Orthoptera in the number and variety of their instincts." . . .

"Respectfully yours,

"THADDEUS WILLIAM HARRIS."

The Dragon-fly (Libellula).

This is, perhaps, the most conspicuous genus of the order

Figure 57.



The Libellula.

Neuroptera, and, as has been seen by the above letter of Dr. Harris, is regarded as the typical genus of the order. On account of the long and slender body, peculiar to the insects of this genus, they have sometimes been called Devil's darning-needles, but more commonly Dragon-flies. The French call them *Demoiselles*, and the Germans *Wasserrjungfern* ("Virgins of the Water"). Their hind body is long, slender, and composed of ten rings. They have four transparent, membranaceous wings, which, although not so handsomely colored as those of butterflies, still are decidedly pretty, many of them glistening like gold, and all resembling richly-embroidered gauze. Some species have brill-

K

iantly colored rings and spots upon their bodies, and a variety of colors and shades of blue, green, yellow, and brown upon their heads and necks, which would justly raise them to the rank of Nature's beauties. During the prevalence of some fashions, their slender form would be considered one of the elements of their beauty; but in this swelling age, and among the expansive circles which are now deemed the most ornamental array of Nature's loveliest and most perfect beings, we presume the porcupine, with erected bristles, would be generally esteemed the more beautiful animal.

The dragon-flies are hardly ever seen at rest, but are in continual motion, flying past us almost as quick as lightning, and winging their way through the air over gardens, meadows, rivulets, and ponds. The water is their birth-place; but when they assume the perfect-winged form they seem to sport with unbounded joy in the airy element, as if they had reached a more elevated and more joyous sphere, and they only approach the water again, flying over its surface, for the purpose of confiding to its placid and nurturing bosom the cell-germs of their future offspring.

Notwithstanding the very flattering titles with which the French and Germans have honored them—on account of their cleanliness, their delicate form, and the beauty which they attributed to their colors and motions—we can hardly look upon them as deserving such names, when we consider their rapacious character and cruel dispositions. Instead of being mild and gentle, like the butterflies or other winged inhabitants of the air who draw their nourishment from the fruits and flowers, these insects are savage beasts of prey, merciless assassins, who plow the airy waves for no other purpose than, falcon-like, to catch with their claws all kinds of winged insects that they meet, and devour them with their powerful jaws. Nor are they at all dainty in the choice of their food; for the fat, blue meat-fly, as well as

all kinds of butterflies, mosquitoes, and caterpillars, are delicious morsels for them.

It is, however, in this their murderous character and rapacious habits that their chief use to man consists; for, being themselves directly incapable of injuring him, they rid him of insects that are directly capable of annoying him by biting and stinging. Thus, if a few dragon-flies be shut up in a house for only a short time, they will effectually purify it of all flies, mosquitoes, or other troublesome blood-suckers, in the same manner as toads, so much despised and trod upon, will destroy whole armies of disgusting cockroaches, and several species of running beetles (*Carabi*) will destroy bed-bugs if shut up in the places which these injurious insects infest.

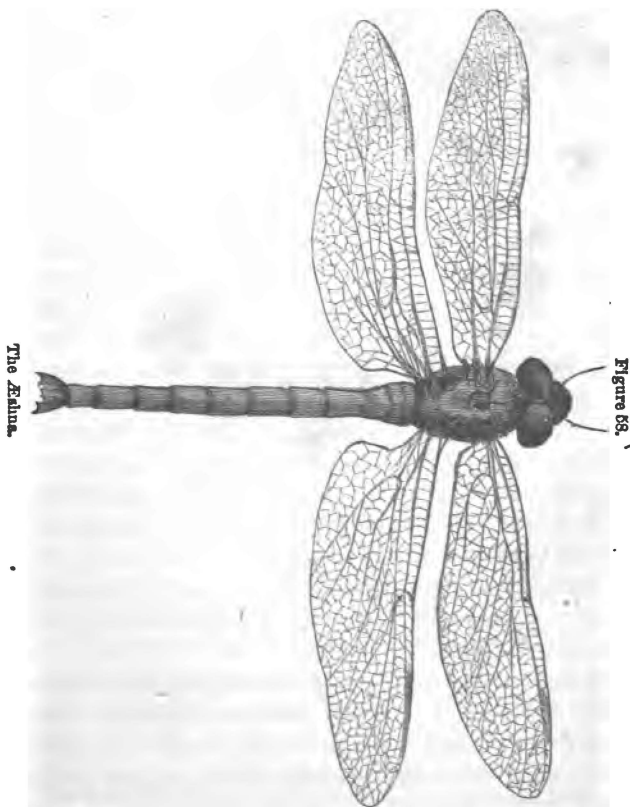
Here, again, we see the practical utility of the study of Natural History in all its details. How many take measures to drive out of their gardens the harmless toad, ignorantly bringing upon themselves much greater mischief by the accumulation of noxious insects which the toads are destined to destroy, and would destroy, if allowed to carry out the benevolent designs of Nature that placed them there. So, also, would many be horrified to find beetles such as *Harpalus calliginosus*, *Agonoderus pallipes*, etc., in their rooms, or beds, even if the latter were infested with that worst of all household pests the bed-bug, and yet the former are harmless, can not bite or sting, and would surely and effectually destroy the latter.

So, too, the dragon-fly, which may be handled by man with perfect impunity—for it can not bite, or sting, or poison him—is often a source of terror in a house or garden, where it might be extremely useful in destroying mosquitoes if allowed to remain. Only a short time ago, while on a visit to a friend in the country, we were much amused to see one of the young graduates of one of our universities terribly frightened at a large dragon-fly which had entered the

open window, and was flying swiftly around the room in search of mosquitoes and other insects. The ladies screamed with terror in order to make themselves conspicuous, and the valiant young gentleman, proving himself not only a son of Minerva, but also of Mars, covered his head, and, arming himself with a cane, after some considerable effort succeeded in slaying this *monstrum horrendum*. He took it up in a paper, and, like Hercules with the lion's skin, carried it to his mother as the trophy of his valor and courage. His mamma, of course, with a smile of satisfaction, admired the manly courage of her beloved boy, but at the same time advised him never again to expose his valuable life without the direst necessity.

How much of useless fear a little knowledge of Natural History would have saved in this case, and how much positive good might be secured to every individual did he but understand the nature and uses of even the insects around him! In what a different light this same insect appears to one acquainted with its natural history and poetic associations, may be seen from the following extract from a note received from a lady of this country, justly celebrated for her scholastic and dramatic accomplishments, the note being accompanied with a well-preserved and beautiful specimen of *Libellula*: "Perhaps he will be nothing new to add to the doctor's collection; but I had such fine success in putting him into an eternal slumber, by the use of chloroform, without injury to any of his bodily members, or touching with spoil his delicate implements of locomotion, that I consider him worthy to be handed over as a candidate for immortality by being placed among other monstrosities of the doctor's study. Though called 'ye Devil's darning-needle,' I don't really think the devil ever mended with him, for he died a Catholic, as you may perceive if you examine closely. He wears the sign of the cross, enameled in Nature's own handiwork, on his back, just between the

wings. I do not know whether he be of celestial origin, but opine it will not be well to 'wake' him, according to the religious custom of mourning the dead, or glorifying their manes, so immemorially adopted by that strange and ancient people who cling with such reverence, in life or death, to the symbol of their faith—the Cross."

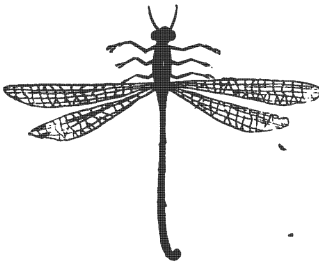


Dragon-flies may be divided into three different genera, viz. :

1. *Libellula*, with a flat, short body (Fig. 57).
2. *Æshna*, with a round, cylindrical body (Fig. 58).
3. *Agrion*, with a small body, short, broad head, in which the eyes are placed at a distance from each other (Fig. 59).

The wings of the first two genera are always horizontally expanded; but the wings of the last genus, when at rest,

Figure 59.



The Agrion.

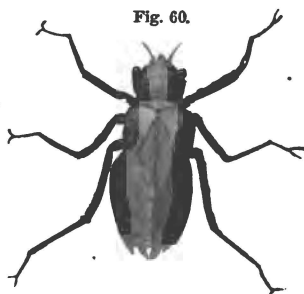
are directed backward, touching each other. They have four jaws, which are covered with a helmet-like membrane, giving them an ugly, ferocious appearance, but which is really nothing more than the under-lip, with which they are enabled to seize their prey.

The larvæ, or grubs of the dragon-fly, live in the water. Those of the genus *Libellula* are short and thick; those of *Æshna* are longer; and those of *Agrion* are very slender, and the smallest of all. Their color is generally brownish green; their head, thorax, and hind body distinctly separated, and the latter composed of ten ringlets. They swim quite well. Their breathing is effected by the hind extremity of the body, as any one may observe who will take them out of the water, and leave them so about a quarter of an hour, and then put them into a flat vessel scarcely covered with water.

After spending ten or twelve months under the water, these larvæ transform themselves into the perfect-winged insect, and henceforth live in the air. Their metamorphosis may be almost daily observed from the month of April until October, but occurs principally in the months of May and June. But this transformation does not take place in the water, but out of it; and, when ready for their meta-

morphosis, the larvæ climb up the stem of some water-plant, and in about two hours after are capable of raising themselves up by their wings and flying away in the air. This whole operation may be witnessed by putting the grubs into a pail of water, and placing in it some sticks or branches upon which they may creep up and prepare themselves for their aerial journeys. Fig. 60 represents one of these grubs, a larva of the *Æshna grandis*.

As soon as their wings are dry they fly away with the same rapidity and with the same design as birds of prey, making hundreds of evolutions, up and down, upon the banks of rivers, ponds, and brooks, or sailing over gardens and meadows, and along the fences and shrubs, seeking something to eat.



Grub of the Dragon-fly.

The manner of their copulation is also very curious. The male fastens the extremity of the hind body, which somewhat resembles a pair of pinchers, to the neck of the female, and thus united together, one behind the other, they fly about for hours. The female afterward deposits her eggs, which are very small and white, upon the surface of the water, where they sink to the bottom, and in course of time are hatched by the caloric of the atmosphere.

The WATER-MOTH (*Phryganea*) is another very interesting genus of this order, which also has its birth-place in the water, but which is not so rapacious and cannibal-like in its habits. Its larvæ are very numerous, look like caterpillars, and live in the water, breathing by means of gills. They metamorphose into moth-like insects, having pendant wings, very small and transparent.

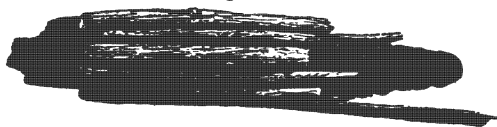
As these larvæ are not able to swim, during their abode

in the water they manufacture a covering around their thin bodies, composed of straw, grass, or pieces of wood, or small woody stems. With these they form a case, open at both ends, in which they are enabled to sail about as if in a row-boat. For this reason, probably, the Romans called this insect *Ligniperda*, and the Greeks named it *Xylophoros* (wood-destroyer), but improperly, because they use only old and decayed wood for their purposes.

These larvæ, with their transportable cases, are found at the bottom of all those slowly-running brooks, ditches, swamps, and ponds in which aquatic plants grow abundantly, for they are herbivorous and live principally upon the water-crawfoot (*Ranunculus aquatilis*). The internal part of their case resembles a hollow tube, with two openings, one for the hind body and the other for the head, which is always protruding from it. They creep on the bottoms of rivers, ponds, etc., by means of their six feet near the neck, which are also kept out of the case, and by which they also drag their case along with them wherever they go.

Our highly-esteemed friend, Samuel W. Seton, Esq., one of the Superintendents of the Public Schools in the city of New York, and a great amateur and promoter of the study of natural history, presented us with several zoological specimens, sent to him from Baraka, on the Gaboon River, in Africa. Among these we found some portable cases of water-moths, which were of much larger size than our indigenous species; but as they will convey a very good idea of the latter, and are themselves somewhat remarkable, we give a representation of one in Fig. 61.

Figure 61.



Grub of the Water-moth.

The **HORNED CORYDALIS** (*Corydalis cornutus*), so named by Latreille, is a genuine American net-winged insect, the male of which is provided with two strong pinchers. Its



Figure 62.

Horned Corydalis—Male.

habits and characteristics are so much like the other neuroptera already described, that we shall simply give a representation of them. Fig. 62 represents the male, and Fig. 63 the female *Corydalis cornutus*.



The DAY-FLY (*Ephemera vulgata*) is another interesting genus of this order, and perhaps the most wonderful of all in its brief history and sudden transformations. It is an inhabitant of Europe as well as of America, and may often be seen in great numbers emerging from the surface of our rivers, lakes, and ponds. In their perfect or winged state they live only a short time, as their name implies, many of

them dying on the same day in which they were born. The name of Day-flies was given them many years ago by Aristotle and Pliny (*Ephemerius Diaria*), and the same characteristics that made them an object of curiosity then attach to them now. They are quite handsome little creatures, carrying their citron-colored wings perpendicularly to their backs, like butterflies, among whom they might be placed were not their birth-place and their metamorphoses so different. Besides, in their winged form they live only long enough to deposit their eggs, and then die.

For the short duration of their ethereal life, however, they are sufficiently indemnified by their long existence as larva and pupa, those conditions continuing from two to three years, during which time they dwell under the water on the muddy ground, which is their food. The larvæ proceed from a ball, or cluster of numerous eggs, which have been deposited in the water by the female fly. They are of a brown color, composed of fourteen joints, and have two black eyes, two antennæ, short fore feet directed outward, like those of a mole, for the purpose of digging, and their whole body is only about an inch long.

After they have attained their full size, generally in the months of June or July, they swim to the surface of the water, where they cast their skin and fly off into the air at the same moment, so that it seems as if they really flew out of the water as perfect insects, without undergoing any transformation. Every where the eyes are turned thousands upon thousands of them are seen arising from the surface of the water, like a series of rockets. In the same moment that the pupa are seen swimming on the water, they are also seen flying up into the air in their perfect condition. If one is in a boat, and stretches out his hand to catch a swimming pupa, he will have instead the perfect day-fly, for their metamorphosis takes place the moment they feel the atmospheric air.

Some years ago we observed multitudes of these insects emerging from the Raritan River, in New Jersey, near Trenton, but never have seen such an enormous quantity of them as we once witnessed near the city of St. Petersburg, in Russia. We were crossing the River Neva in a little row-boat, and encountered probably hundreds of millions. The whole atmosphere from one shore to the other was filled with them, and from Lake Ladoga down to St. Petersburg, as far as Oranienbaum. The light of the sun was intercepted as in a thick fog, so much so that nothing could be distinguished at a distance of a few yards. The atmosphere had something the appearance it presents in a violent snow-storm, and thousands of day-flies fell into the boat and all over our persons, while the fishes in the water, the birds in the air, and the domestic fowls upon the shore were every where feasting upon them.

In the evening these flies are strongly attracted toward a light, perhaps more so than any other nocturnal insect, and it is very amusing to see the crowds of them that fly through an open window and dance around the light, making a variety of turns, and circles, and waltzes. They fly so close together, and glisten with such splendor, that the observer sees a ribbon of gold continually revolving around the light, or imagines a celestial globe of living circles revolving in all directions, while the light represents the central sun. This spectacle may be increased to any extent in proportion to the number of lights placed in a room, until the atmosphere be filled with these living miniatures of the solar system.

Butterflies require a considerable time to issue from their cocoons, and get their wings dry and expanded for flying; but these little day-flies perform the operation of extricating their body, wings, and feet from their pupa, and getting ready for their aerial journeys, in less time than a man occupies in taking off his coat. And wonderful as is the

whole history of this diminutive and short-lived insect, as we have thus far related it, we must still add another phenomenon connected with it, and crowded into its brief existence, which is not observed in any other insect, viz. : that many of them, after flying about in the air, cast their skin a second time, and leave it attached to the trunk of a tree, or on a fence, or house, in such a perfect condition, that no one can tell it from the insect without handling it. Its form, size, and general appearance are exactly like that of the perfect-winged fly in the sitting posture, with its citron-colored wings erect like those of a butterfly.

The ephemeral existence of the insects of this genus has always excited the pity, as their wonderful history has the admiration, of the true lover of Nature. That, after groveling in the earth so long, it should shoot up so brilliantly into the ether, only to enjoy its perfect, winged state just long enough to perform its last great function of reproduction, and then instantly expire, might well excite a passing regret in the minds of its admirers. Often have we seen this little insect in the early morning, sitting near the open blossom of a purple morning-glory, as if instinct had taught it that a similarity of fate had made them fit associates, both breathing their matin song to the sun, whose last setting rays were destined to see them wither and die. Like two unhappy human souls, who find consolation only in their mutual interchange of woe, until their short day-dream is over, and the night of Death lulls them to eternal rest. Reason, however, has assured us that life is not to be measured by its length alone, but that that life is long enough for all the enjoyment of which its recipient is capable, that endures until all the objects of its existence are accomplished. Surely, then, the diligence of this little insect, who so faithfully and successfully "works while it is day," should shame the idle, listless man who trifles away his brief existence, unmindful of the high and noble pur-

poses for which he was created. The insects live longer in proportion than such men ; and man's life at best is short—but a fleeting day, when compared with the long eternity that awaits him. How strange that he should willingly throw that little life away, and carelessly allow the precious pearl, whose value he does not recognize, to be cast away by the rough waves of destiny upon the desolate shore of destruction !

ORDER VI.

VEIN-WINGED INSECTS—(*HYMENOPTERA*).

“QUANTO potius Deorum opera celebrare, quam Philippi aut Alexandri latrocinia.”—This sentiment, uttered many years ago by Seneca, “How much better it is to admire the works of the gods, than the highway robberies of a Philip or an Alexander!” has probably been repeated thousands of times since by students of Natural History. Its truth has been acknowledged and verified by the experience of sages and philosophers in every age. But in no department of Zoology has it been more often recognized and felt than in the interesting order of insects we are about to describe. The practical utility of many of the Hymenopterous insects, their persevering industry, the wonderful ingenuity with which they construct their artificial dwellings, the prudence and economy with which they collect and store up food for themselves and their offspring, have always rendered them the objects of man’s peculiar admiration and care; and notwithstanding, like many of our most worthy and benevolent citizens, they make no show of beauty on parade, they have always been regarded as the most practically interesting and useful of all the insect tribes.

The insects of the order Hymenoptera vary very much in size; some are smaller than a flea, while others measure, with their ovipositor, full three inches. All are distinguished by their four membranaceous wings, which are marked with branching veins, and which are generally shorter and smaller than those of the insects of the foregoing orders. The body of the perfect insect is slender, with the exception of

that of the bee, and may be divided into three parts, viz. : head, neck, and hind body, which are connected together by a thread-like organ. The head consists almost exclusively of two large eyes, two antennæ, and denticulated jaws, and in some species with a proboscis for sucking the nectar of flowers. On the under part of the neck are placed six legs, and above them four transparent, membranaceous wings. Most of the females, and those without sex, as the workers of bees and ants, are armed with a sting, and occasionally with venom, which they infuse into the puncture. On this account the whole tribe has been called *Aculeata* (stingers or piercers). Gall-wasps, ichneumon-flies, wasps, ants, and bees, with many others, come under this denomination, and belong to this order. All the females are provided with an ovipositor, which in some species has the form of a hair, in others the form of a saw, and in others that of a sting. The two former are prominent organs, which are visible and can not sting, except into the soft skin of caterpillars, where they sometimes deposit eggs, but the latter always lies concealed in the body until used as a weapon of defense or revenge.

The larvæ of Hymenopterous insects are of various forms. Some of them resemble caterpillars, having eighteen or even twenty feet, others are maggots without any feet or eyes. Most of the larvæ are of this latter description; but those of the wood and leaf wasps have six horny feet on the neck, and twelve or fourteen fleshy ones on the hind body. All the larvæ of this order are peculiar for living in clean places, such as cells artificially built of wax, pieces of wood, leaves, or mortar; or they dwell in wood, in holes under ground, in gall-apples or oak balls, and many live in caterpillars, but none inhabit carrion, dunghills, or other putrid and filthy places. When full grown, all these larvæ, like those of butterflies, metamorphose themselves into a cocoon woven of silk.

The Hymenoptera are found in almost every part of the terrestrial globe, but they are most numerous and attain the largest size in tropical countries. None of them are nocturnal, but, like the worthy and useful laboring classes of men, they rise with the sun, work unceasingly through the day, and retire to rest as soon as the evening twilight begins to draw its dark and damp vail over the face of nature. They are neither seen nor heard when the cold storm roars and whistles without, when the thick drops of rain or hail come pelting at the windows, nor even at night, though the sparkling moonbeams dance like spectres through the leafless branches; but when the summer's sun first casts its morning rays over the green leaves of meadows and forests, and the sleeping birds awake to greet the rising day, then the humming of these industrious insects begins, and their earnest but monotonous music is heard all over the country. They fly from flower to flower, not to injure or destroy them, but to make them productive by distributing their pollen; or they collect honey and wax for the use of man, or they go about to rid us of innumerable noxious caterpillars and other insects, which they convert into wholesome food for their offspring.

The value of hymenopterous insects as agents in fertilizing plants has many times been demonstrated by experiment. We recollect an instance of this, which transpired many years ago, so connected with pleasant associations that it made a striking impression. While on a journey from St. Petersburg to the transcaucasian provinces, in the month of February, 1825, we were obliged, on account of the intense cold, to stop in the Government of Twer, on the estate of our friend, Gregor Wasiliewitsch Lihatchef, Colonel in the Imperial Garde à Cheval. There we were shown a very spacious hot-house, full of fine flowering plants; and also, among others, about fifteen cherry-trees, covered with blossoms. We congratulated Lady Lihatchef

upon the prospect of a large crop of fruit, when she informed us that her gardener had never succeeded in raising more than one dishful of fruit from all those trees. We assured her that if she would place in her green-house a few full bee-hives there would be a charm about them that would insure her an abundant harvest of fruit. Two years afterward we visited that lady in Moscow, on our return from the Caucasus, when she desired an explanation of the charm connected with the bee-hives; for, said she, "since they were placed in the hot-house all the trees have produced fruit in abundance." We then explained to her that the bees collect the pollen of the flowers, and at the same time bring this fertilizing farina of the stamens in contact with the germ, which then produces the fruit.

So useful to man are all the insects of this order, that we can not find fault, notwithstanding there are no other insects which, when provoked, take revenge upon us with dagger and venom, and notwithstanding a few genera spoil the wood of the carpenter. Their good so far overbalances their evil deeds, that the latter are hardly worthy of mention.

Of the Hymenoptera of North America we shall now have time to notice only a few of the most interesting, because the most useful genera and species.

Figure 64.



The Onerate Gall-wasp.

The Gall-wasp (Cynips).

This is a genus which is very common, and is composed of a great number of species. Its perfect insects are gen-

erally very small, having a curved neck like a hunchback, short antennæ, a short, almost triangular hind body, four colorless wings, and a piercer or ovipositor, as thin as a hair, which it most resembles, and by which they make a hole in the soft parts of plants, into which they deposit their eggs. These punctures in the stems, leaves, or buds of plants produce a swelling of the wounded parts, which, by the irritation of the sucking maggots issuing from the eggs, accumulate the sap, and rapidly increase in size, becoming spongy, or pulpy, or hard within. It is curious, but it is a fact, that each egg grows larger after it has been deposited in the plant, and sometimes doubles its size before the larva issues from it.

These excrescences, called galls, are in reality monstrosities, though they generally present a very fine appearance, so nearly resembling fruits or flowers as to be mistaken for them; but, instead of seeds, they contain the larvæ of insects, which feed upon the juices flowing from the wound they have made in the plant.

The most common protuberances, or galls, are those found on oak-trees, called oak-balls, and those brought from Tripolis, Smyrna, Aleppo, and Mosul, which are extensively known in commerce as a dye-stuff. But we also see green, yellow, or red galls, of the size of grapes, upon several other kinds of plants. Upon the leaves of willows we often find them resembling warts; and the branches of the honey-suckle (*Azalia nudiflora*) are covered with yellowish-green galls of a spongy texture, which, with all the maggots in them, are greedily devoured by many ignorant persons. It is very easy to ascertain whether there are such larvæ in a gall or not by cutting it open; and if the insect has already made its exit there will be a hole left in the gall.

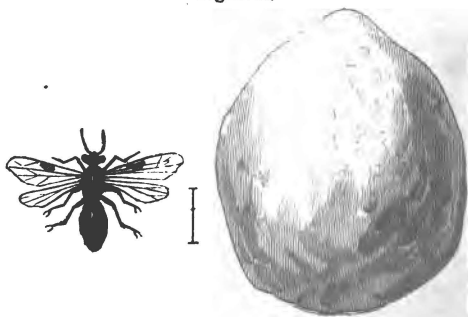
We have received a number of valuable insects, natives of that State, from Professor D. S. Sheldon, of Iowa College, at Davenport, and among others two nests of Gall-

wasps; viz., that of the *Cynips oneratus* (Fig. 64), and *Cynips seminator* (Fig. 65), both found on the white oak.

At almost any season of the year, by examining the small twigs of the white oak, we may find around them clusters of oak-balls, of the size of a small marble, which are as hard as wood. These hard excrescences are the results of the punctures made in the tender twigs by the *Cynips oneratus*, who at the same time deposits its eggs in them. The swelling of these punctures is caused by the gradual enlargement of the egg, and also by the continual irritation of the little maggot, who is thus furnished with food and a secure dwelling until it is ready to perforate the oak-ball and come forth as a perfect four-winged wasp, which metamorphosis usually takes place in June or July. This little wasp is very small, being only about the sixth of an inch long.

Oak-balls of this kind are found every where in North America, and they might possibly be substituted for those we receive from the Levant, and which constitute such a valuable dye-stuff. They have never been used as such to our knowledge; but the suggestion is well worth the attention of chemists and dyers; for, if experiment should prove them as valuable as the foreign oak-balls, a vast amount

Figure 65.



The Sower Gall-wasp.

of expense and trouble might be saved to our home manufacturers. For such purposes they should be collected early in the spring or late in the autumn, as those which are perforated with holes would be of no use as a dye-stuff.

The *Cynips seminator* is one of the smallest of the gall-wasps, and yet the oak-ball, which is the consequence of its puncture, is as large as a walnut, of a reddish color and a rough exterior. Each one of these galls contains a large number of maggots, and when it is ripe, or rather when it has been abandoned by the perfect insects, it is found to contain a soft, spongy, and dry substance, like a toad-stool, which is easily broken and reduced to powder.

A great number of different species of Gall-wasps are found in all parts of the world, and their increase is only to be desired, not dreaded, for, with the exception of the saw-wasps, they do no injury to vegetation, but, on the contrary, are very useful to man; as, for instance, those which produce the oak-apples of commerce (*Cynips Galle tinctorie*), found upon the dyer's oak (*Quercus infectoria*), in the Levant.

The ICHNEUMON-WASPS are another very useful and interesting tribe of vein-winged insects. They are distinguished by their slender body, long ovipositor, and long antennæ, which are always in a continual quivering motion. They deposit their eggs in the living body of other insects, such as grubs, caterpillars, and all kinds of larvæ, upon whose substance they feed. Although able to pierce caterpillars, grubs, and cocoons, yet they never use their ovipositor for defense, and consequently can be handled with impunity.

The larger ichneumons deposit only one egg in each larva, as in the caterpillar of the Asterias Butterfly; but the smaller ones deposit several hundred eggs in one larva, as we have seen in the potato-worm, from whose skin hundreds of small ichneumons creep out, and immediately trans-

form themselves into white silken cocoons, which resemble rice-seeds in appearance, and which cover the whole body of the emaciated and dying caterpillar.

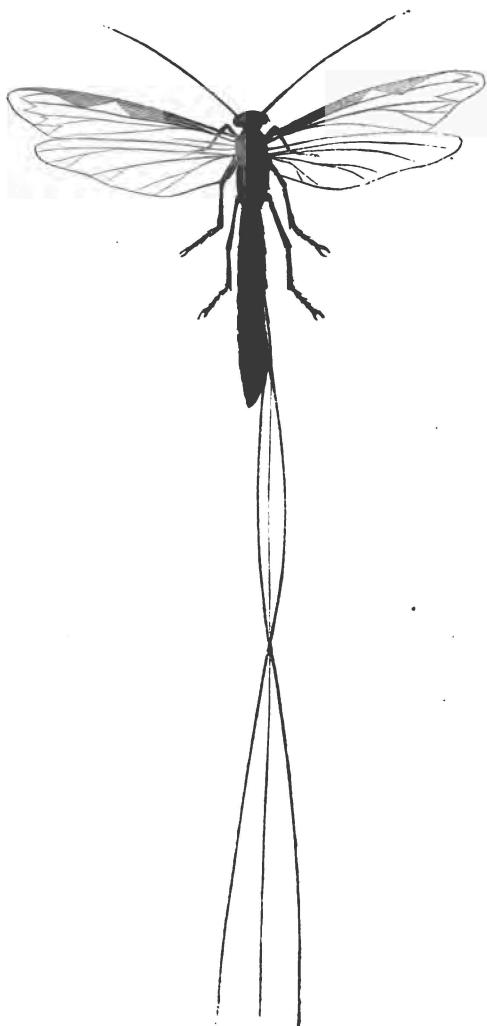
Very minute ichneumons, scarcely visible to the naked eye, deposit their eggs in the eggs of different lepidopterous insects, and from these the perfect ichneumon issues about three weeks after.

The family of Ichneumon-wasps is immensely large in all parts of the world. In 1829 the Swedish entomologist, Gravenhorst, published three large volumes on "*Ichneumonologia Europæa*," to which Professor Nees, of Bonn, made a considerable addition; but if one should undertake to describe the genera and species of the American, Asiatic, African, and Australian ichneumons, of all of which very little is known, he would occupy more than twenty large volumes.

The largest ichneumon of this country is the *Pimpla LUNATOR* (Fig. 66), the body of which is about one inch and a half, and the ovipositor three inches long. One would naturally suppose that so long an organ, with the two side bristles, which serve as a scabbard, would be very burdensome to this insect; but by watching her movements he would soon see with what ease and skill this little creature manages that instrument, and by means of it introduces her eggs into those larvæ which are concealed in deep holes under the bark of trees, or in decayed wood.

We have before spoken of the handsome green caterpillar of the *Asterias* Butterfly, represented in Fig. 30, and found so commonly upon the leaves of all the umbelliferous plants. Our attempts to raise the handsome *Papilio asterias* from these caterpillars have often been frustrated by a species of ichneumon which, stinging the caterpillar, grows within its body until it forms its cocoon, when it destroys the chrysalis, and then emerges from the cocoon instead of the

Figure 66.



Long-tailed Ichneumon-fly.

butterfly. This mischievous wasp we have called *Ichneumon asteriæ*, and the co-

Figure 67.



The Asterias Ichneumon-fly.

oon from which it issues, which is properly that of the *Papilio asterias*, is represented at Fig. 67. How the female ichneumon knows that the caterpillar in which it deposits an egg has not been already pierced by another insect, and why it only deposits one egg in the body of each lar-

va, is among the mysteries of nature that we can not fathom, much less explain.

The GOLD-WASP (*Chrysis*) belongs also to the numerous family of Ichneumons. It is distinguished by its splendid colors, having a cylindrical yellow abdomen, with a green neck and head. It is a little larger than a common fly. If you take one in your hand, it will bend the abdomen downward until its extremity reaches the head, giving the insect the appearance of a ball or coil. Its sting is harmless, and it deposits its eggs in all kinds of larvæ. Its beauty, and the impunity with which it can be handled, would undoubtedly make it much admired were it not for its fetid odor.

Another useful family of insects belonging to the order Hymenoptera are those wasps which are called by the Germans *Raupentödter* ("Caterpillar-killers"), because they kill every kind of larvæ, such as grubs, spiders, cockroaches, etc., with which they nourish their young. Of this family there are several genera, of which one of the most prominent in this country is

The MUD-WASP (*Sphex Pennsylvanica*), Fig. 68.—This

insect is more than one inch long, and of a dark-blue purple color. It makes its abode in the loose, sandy ground, and when digging its hole resembles a dog digging after mice, throwing the earth under it toward its hind body with the fore feet. If the pile of sand becomes too high or troublesome, it

Figure 68.



The Mud-wasp.

places itself upon it, and throws the earth behind it with great force until it is leveled. As soon as its subterranean abode is prepared, it seizes a large spider, or a caterpillar, or some other insect, stings it in the neck, and then carries it into its hole. It is curious to see one of these wasps take hold of a cockroach, seizing it by one of its long antennæ, and continually walking backward, compelling the cockroach to follow, notwithstanding its great reluctance and constant opposition, until both have arrived at the hole, when the wasp kills it by a sting in the neck, then tears it into pieces, and carries it into her subterranean dwelling as food for her offspring.

There are several other species of this wasp which manage in a similar manner with their prey, but which make their dwellings in rotten wood, as the *Philanthus*; or build dwellings of clay upon the walls of houses, as the *Pelopæus*. There are others which build cells resembling honeycombs, which they manufacture out of decayed fibres of wood, after converting them into a paper-like material. One species of these wasps fasten their abode, which consists only of a few dozen combs, upon the twig of a bush or

tree, while another makes a globular paper-nest of combs under ground, which nest is sometimes a foot in diameter, and actually resembles a subterranean city, having houses and streets, the whole being surrounded and fortified with a paper wall.

But of all the ichneumon tribe, probably the HORNER (*Vespa chartaria*) is the most celebrated for its ingeniously-built dwelling, it being of a globular form and filled with cells, which are constructed of the paper which this insect manufactures out of wood. These hornet's nests are found every where in North and South America, either suspended in the air or closely built around the branch of a tree or under the eaves of houses. They are a sort of solid, round vessel, often more than a foot in diameter, the walls of which are of a white or gray color, and in appearance and thickness closely resemble thin pasteboard. Such a nest often contains a dozen or more combs, is several stories high, with hexagonal cells, and has its entrance, which is about the diameter of a finger, at the bottom. The inhabitants of such a dwelling, several thousand in number, are composed of workers, females, and males, the latter of which are the largest. The workers and the females are provided with a sting, which is justly much dreaded, children having not unfrequently died from its effects, and adults often having experienced severe suffering from the same cause. The hornets are of a dark-brown color, and are known to every one who has spent much time in the country.

It would be interesting, and possibly might be made very profitable, to institute experiments with the wood from which these insects manufacture their paper; for if a new material for the manufacture of paper could thus be discovered, the fortunate discoverer would be well repaid, and the country would really be enriched by possessing another source of revenue, and we should not be obliged to import so many rags from Trieste and other Austrian sea-ports.

All the insects of this order thus far enumerated are more or less useful to man, by their agency in the destruction of such a vast number of caterpillars, grubs, and other insects directly injurious to vegetation. But we must mention one family of the ichneumons that are as destructive to vegetation as they are to the caterpillars, viz., that composed of the several genera of the Saw-wasp.

Now there is one fact in connection with the larvæ of this family which should be mentioned in the beginning. The true caterpillars, which are metamorphosed into moths and butterflies, never have more than sixteen legs; but many of these larvæ are found which almost exactly resemble caterpillars in appearance, but which have more than eight pairs of legs, and these are called pseudo or false caterpillars, because they do not transform into lepidoptera, but into hymenopterous insects.

Formerly, many experienced naturalists held the opinion that all the wasps which they found issuing from the cocoons spun by these pseudo-caterpillars were the production of ichneumons; but more extensive and closer investigations proved this to be an error. The pseudo-caterpillars proceed from eggs deposited by different species of hymenoptera, and each propagate their own species, some being ichneumons, others very different species of wasps. Those which feed on leaves deposit their eggs on them, while other wasps, which feed on wood, deposit their eggs under the bark of trees. When fully grown, most of the caterpillars go to the ground, and transform themselves into cocoons under its surface. None of these wasps are provided with a venomous sting.

Notwithstanding the pseudo-caterpillars, like the true ones, are ornamented with a great variety of colors, cast their skin four times, and spin silky cocoons, yet they may be recognized as false by their globular brown or black head, and by the number of their feet, which sometimes is eighteen, sometimes twenty, and even twenty-two.

Saw-wasps (Tenthreds).

These insects are distinguished by the double saw at the extremity of the hind body, with which all the females are provided, and with which they cut, like a carpenter, little slits in the stems and leaves of plants, into which they drop their eggs. The larvæ of the Saw-wasps exactly resemble caterpillars, and they feed upon the leaves of those plants upon which their mother had glued her eggs, that is, upon which they were born. They cast their skin four times, and, when fully grown, some species go into the ground in order to make their cocoons; while others metamorphose and fasten their cocoons on the stem of a plant, like the caterpillars of butterflies.

The ELM-TREE SAW-WASP (*Cimbex Ulmi*) is one of the largest insects of this family. It is about one inch long, and its wings expand about two inches. Its head and thorax are black, the hind body blue, the antennæ of a nankeen color toward the top and dusky at the base, the feet pale yellow, and the legs black. The female may be seen depositing her eggs, early in June, upon elm-trees, the leaves of which serve as food for the insect and her offspring. The caterpillars which issue from these eggs are of a greenish-yellow color, and have twenty-two legs. When fully grown, they descend from the tree, conceal themselves under the fallen leaves on the ground, and there spin their cocoon, within which they remain during the whole winter, and until the following May or June, when the perfect insect makes its exit.

The Wood-wasps are the most destructive insects of this whole order, and often do great injury to our forest, as well as our ornamental and fruit trees. Perhaps the most conspicuous insect of this species in this country is

The PIGEON TREMEX (*Tremex Columba*), Fig. 69. This insect is more than one inch long, and, like the whole fam-

Figure 69.



The Pigeon Tremex.

ily of them, is provided with a borer, which is one inch long, as thick as a bristle, of a black color, and always concealed within the body when not in use. Elm-trees and button-wood are their favorite points of attack, into the trunks of which they bore holes half an inch deep and drop their eggs therein. In performing this operation they not unfrequently become victims of their zeal and labor, driving in their borer so tightly that they are not able to extract it, in consequence of which they are fastened to the spot and perish by starvation. Their eggs are oblong, and the larvæ, or grubs, proceeding from them are in turn often stung by the long piercer of the Pimpla, who smuggles her cuckoo egg into the hole upon that of the Tremex, and in so doing also loses her life very often, by being in like manner fastened to the trunk of the tree.

The larvæ of the wood-wasp are yellow, somewhat resembling the grubs of the May-beetle, and are often found in blocks of wood at the shops of carpenters. They feed exclusively on wood, making long passages through it, and thus destroying much valuable timber; and as they grow

very slowly, and remain several years in the larva state, they often become injurious to whole forests of trees. When fully grown, they are about one inch long, when they make their cocoon; and in a few days after undergo their final transformation into the perfect insect.

We now come to a much more wonderful, and, with one exception perhaps, the most interesting genus of the whole order Hymenoptera—a genus of world-wide notoriety, and one that seems to partake in a remarkable degree of that intelligence which naturally belongs to the highest order of animals. We mean

The Ants (Formica).

These insects are found in all parts of the globe, but in greater number and of larger size in the tropics, where their vitality is not affected by cold weather. The genus *Formica* contains a great number of black, yellow, red, and brown species, of very different sizes, some being only two or three lines, while others are an inch long. Their head is broad, thorax small, and hind body large; their upper jaw is very wide, like a broad forceps; their antennæ small, of a triangular or elbow shape, similar to those of the Snout-beetle; their eyes are very small, and the sting is sometimes wanting.

Each species live in a social community by themselves, in ant-hills, and is composed of males and females, who are provided with wings; and workers, who have no wings. The males and females, of which there is a great number, have nothing to do but to enjoy themselves and multiply their species. The wingless workers do all the necessary in-and-out-of-door business: they build their habitation, or ant-hill, of earth, pine-wood leaves, and woody fibres, with which they also manufacture their subterranean caverns: they feed the young ones, and carry the cocoons from one

place to another with their large jaws, the instruments with which they perform all their work. The maggot is white, without feet, has a horny, brown head, and is fed like a little bird by a worker, and after a few weeks' growth spins a white cocoon.

All ants are benumbed during the winter, and lie immovable in their subterranean abodes, without taking any kind of food. In the summer, however, their food is very various. They eat all kinds of fruit, dead as well as living insects, sugar, honey, and other sweet juices, principally that of plant-lice, called honey-dew, which exudes from their bodies without doing them any injury. Plant-lice, on this account, were called by Reaumur, "the milch-cows of the ants;" and to ascertain their abodes in the trees it is only necessary to follow the march of the ants, who will climb to the top of the highest tree in search of their beloved friends, whom they caress in the most affectionate manner, sucking the honey-dew from their bodies without harming them in the least, although they will attack and devour every other kind of insect, even the largest caterpillars. This honey-dew, of which the ants are so fond, is nothing but the digested vegetable juices, which are continually exhaled by the plant-lice.

As has already been intimated, ants are not only herbivorous but also carnivorous, and almost any kind of animal food is palatable to them. If a small dead animal—for instance, a mouse or a rat, a frog or a lizard—be put into one of their ant-hills, it will be converted by them into a very well-prepared skeleton in less than twenty-four hours; but if it remain longer, it will fall to pieces, leaving only the bones, because the ants will eat up even the ligaments and cartilages.

White, oval bodies, resembling barley seeds, are found in the ant-hills during the summer, which have sometimes, and now are by the common people called ant-eggs, which

form an excellent food for all kinds of warblers, such as mocking-birds and nightingales. In the cities of Europe they are sold by the quart in the markets. These miscalled ant-eggs, which are as large, and even larger than the ants themselves, can not be their eggs, but are the cocoons of the metamorphosed maggots, of which the workers take so much care. If they are taken out of the hill and scattered about over the ground, it is curious and astonishing to see with what anxious solicitude and indefatigable zeal the workers pick them up again with their jaws and carry them back into the hill, for greater safety transporting them deeper than ever in the ground. In order to collect these pupæ, or cocoons, as food for warblers kept in cages, it is only necessary to fix a dry and shady spot of ground near one of their ant-hills, then stir up the hill with a stick, or pour a considerable quantity of water in it, and after a few moments the workers will convey the cocoons to the shady and dry spot, where they can be collected at pleasure.

The real eggs of ants are as small as a grain of sand, and almost invisible, white and shining as if they had been varnished. The maggot, issuing from each egg, has twelve ringlets, and in the pupa, which is semi-transparent, all the members of the perfect insect are visible.

Most of the ants are provided with a small sting, which, when applied to human flesh, produces a little itching, sometimes a slight swelling and inflammation, caused by the venom of the insect, which enters the wound with the sting. This venom is nothing else than the well-known formic acid, which produces the pleasant sour odor when the ant-hill is stirred up, and which is procured by druggists for medicinal purposes. This acid substance may be obtained by putting a certain quantity of ants into a bag, placing the bag under a press, and then squeezing out their fluids, but it may also be obtained much easier by a chemical process. This formic acid changes vegetable blue to red; so that if ants pass

over larkspur, borage, or other blue flowers, and discharge any of their fluid substance upon them, their blue color will be changed into red.

In the ant-hills among the pine woods we very commonly find little resinous cakes, formed like pebble-stones, which, like other building materials, are carried into their dwellings by the ants. This substance, saturated with the formic acid, is very similar to the so-called frankincense, used in churches as well as private houses as a perfume, because when put upon lighted coals its smoke emits a pleasant, amber-like odor, somewhat resembling that of frankincense, but which is undoubtedly due to the presence of formic acid, with which this resinous substance is impregnated by the ants. The true frankincense (*Olibanum*, *Libanus thurifera*) is brought from Central India, and is obtained from the resinous juice of a tree called *Browellia serrata*. This resin is used in India not only for its perfume, but as pitch, when boiled with oil, for pitching the bottoms of ships; and in medicine for its stimulant, astringent, and diaphoretic properties. The formic acid was first discovered, about a century ago, by the German chemist Marggraff, in Berlin, and it is now also artificially prepared by distillation for medicinal purposes, as well as for its perfume when burned.

Many curious and interesting phenomena have been observed in connection with the habits and customs of the ants, a few of which we must notice in this place. In the pleasant evenings of the month of August there are often seen swarms of male and female ants rising in large columns perpendicularly into the air, ascending and descending in large masses, and, after thus manœuvring for a time, they come down to the ground, lose their wings, and die, as soon as the females have deposited their eggs in the hills and left them in charge of the workers. These flying columns of ants sometimes appear like a mass of thick smoke,

and have often been seen in such numbers as to alarm many people, who supposed some building was on fire at a distance.

But the closest observations have been made, and the most wonderful phenomena have been witnessed, when the ant-hills have been placed under a glass box, where all their movements could be distinctly watched. The high degree of intelligence which these little creatures display under such circumstances has never failed to excite the wonder and admiration of every observer. Looking at the ants through such a glass box, we see here and there a female, accompanied by some of the workers, running along dropping her eggs, which are immediately taken up by her attendants and carried away. These eggs are of an oval form, milk-white, very small, and opaque; but by-and-by they become larger, growing like the eggs of the gall-wasp, and then they become transparent, when a black spot may be seen in the centre of each, which is the embryo of the future ant. These eggs will all dry up and perish if the workers are removed; for, in order to be developed, they must be continually moistened with the saliva of the worker; and so, even in insect life, the sweat of the laborer becomes the source of plenty and prosperity. With this nourishing care the eggs teem with life, and in about two weeks the maggot is hatched, which is transparent, but without feet or antennæ.

The ants are proverbially an industrious race, and when the first rays of the morning sun fall upon the ant-hill those that are on the outside run hastily within, rousing the slumberers, touching all those that are inside the hill with their antennæ, pressing and pushing them until the whole population is in motion. The lazy ones and those that move too slow are seized with the jaws and carried up to the top of the hill, as well as the maggots and pupæ of the nurseries, where they are all exposed to the sun's rays about a

quarter of an hour, after which they are carried down under the first stratum, and there fed.

We may receive still greater evidence of their intelligence if we observe their language of signs. If the ants on the outside of the hill are disturbed by strange ants, part of them will at once put themselves into offensive and defensive position, while others will immediately run into the hill and alarm those within, who then come rushing out to assist their brethren in attacking the foe, while the guardians of the nurseries carry the maggots and pupæ to the lowest part of the hill for greater security.

So, if one ant discovers a closet where are sweet articles, such as fruit or sugar, it quickly returns to its fellows for the purpose of acquainting them of its discovery, and in a very short time whole swarms of them will arrive with the discoverer to divide the spoils. They go out in companies, also, to drink, of which they are very fond; but if one of them is disturbed in so doing he communicates the fact immediately to all the rest by pushing the one nearest him, who passes on the news in the same way to all the rest, when all receiving the sign run to the hill; but if any one is not attentive to such admonition, he is seized by the legs and dragged to the hill. In general, they give signs to one another in all their operations by their angular or elbowed antennæ, which work somewhat like the old French telegraph. With their antennæ they also express their friendship and love, as we may see when we observe them caressing one another, or their friends the plant-lice.

Their social sympathy, and their mutual attachment for one another, is as great, and even greater than that of the bees; for it is well known that, even when cut into pieces, they do not cease to defend their mansion and their offspring. The head and thorax of an ant, without any hind body, have been seen to carry a pupa to a place of security. And Professor Latreille cut off the antennæ of some ants,

and then let them go back to the hill, when some of their brethren commenced moistening the wounded parts with their saliva, which probably is their remedy. So, too, ants which had been separated from the hill under glass for four months were brought back, and were immediately recognized by their brethren, who commenced a mutual caressing with their antennæ and jaws, while general satisfaction and joy was distinctly seen throughout the whole community.

Again, the ants, which inhabit hills favorably situated for finding plenty of food and drink, are seen to play and frolic with one another like little dogs or kittens. On fine, sunny days they may be seen in crowds running about on the outside of their nests, the antennæ of each moving with great rapidity, while some with their fore feet caress the heads of others, and some rise up in pairs on their hind feet, take hold of one another with their jaws, throw each other upon the ground, and, in short, wrestle like turners without injuring one another.

With regard to their nourishment, also, or at least their need of it, the antennæ seem to be the principal organs of their language. Having no store-house like the bees, those ants which remain at home are obliged to wait until the others bring home food for them, which generally consists of small insects, of which each of the resident ants take a morsel. But if those who go in search of food find only fruit, or large bodies, such as worms, caterpillars, dead mice, or lizards, which they can not carry home, they suck out all their liquid substance, preserve it in their own stomachs, and, when they get back to the hill, discharge it by drops into the mouths of their comrades. When one is hungry, therefore, it touches with the antennæ that one by whom it desires to be fed, and the latter, after such an admonition, opens its mouth and feeds the former with the fluid substance it has preserved in its stomach, while the

recipient expresses its gratitude by caressing with the fore feet the head of the donor.

Now, although among each community of ants there reigns entire love, friendship, unity, and equality; still, if two different species come in contact, they make war to the death, just as rival human nations do, only there is no cunning diplomacy or base espionage used by the former. They fight bloody battles, a great number are mutilated, many lives are lost, and their fortresses are besieged, taken, and destroyed. In these bloody contests, as among men, the workers alone have to fight and suffer, while the males and females, like emperors and kings with their royal families, fly to some distant place of security, and order their subjects to mutilate and massacre one another for the sake of their glory, ambition, and power.

Some very remarkable stories, sounding more like fiction than like facts, have been told by various ancient authors concerning the "Wars of the Ants;" but the most astonishing descriptions ever related were abundantly confirmed by the observations of Mr. P. Huber, of Geneva, in Switzerland, who published a monograph concerning the ants in 1810, "*Mœurs des Fourmis indigènes*," as well as afterward by Mr. Hanhart, of Basle. The latter gentleman describes a battle he witnessed between brown and black ants, and states that the brown ants had two hills near one another at the foot of a tree, while the black ants occupied five hills near together at a distance of forty feet from them. In the month of June, at 10 o'clock A.M., he observed a great movement in the hills of the brown ants. They marched out to the middle of an uncultivated field, which was situated between them and their enemies, and arrayed themselves in a long, uninterrupted, oblique line of battle, which line was about twenty-four feet long, and consisted of only one file. In the mean time, the much more numerous, but much smaller black ants, also marched out and arrayed

themselves in a line of battle, three ranks deep, their right wing being covered by a mass of several hundred, while their left wing was supported by nearly a thousand individuals. Thus the two armies moved one against the other, until they approached each other near enough to commence the battle, when the two masses which supported the wings formed oblong squares, from three to four inches wide, without taking part in the affray. Then the fighting began with fury, the jaws, stings, and venom constituting their formidable weapons; and very soon mutilated bodies, heads, and headless trunks, torn-out feet and legs could be seen lying all over that miniature battle-ground. The fight was continued with great vigor until noon, when the massacre ceased, and the remnant of the brown ants took flight to parts unknown, while the black ants, as the victors, took possession of the fortresses of the enemy, carrying along with them their wounded fellow-soldiers.

Such stories seem really wonderful; but they are true, and may be seen in our pine woods every summer by every person who will take the pains to be an attentive observer of natural phenomena, and not be content to go through life a mere thoughtless, promenading automaton.

We have called the ants useful insects, and so they are in many ways. They furnish us with *formic* acid and frankincense, and they rid us of many injurious larvæ and other noxious insects, besides destroying carrion; but they are injurious to bee-hives, flowers, cherries, pears, and other fruit. They are more numerous and voracious in hot climates. While in the island of Hayti, we left open, during only one night, a case containing more than three hundred specimens of valuable insects on pins, and the next morning we were much grieved, as well as surprised, to find the case entirely empty; nothing but the pins were left; all the insects had been devoured by the ants. No article of food, no clothing, and no papers of importance can be

secured from their voracious appetite, unless preserved in tight bureaux or boxes of mahogany, which they do not attack; but furniture of pine or oak wood will be destroyed by them in less than three months.

Of their dangerous voracity in the tropics, and carnivorous propensity, there are many strange but well authenticated instances. Dionisio Carli, of Piacenza, Missionary in Congo, Africa, was once sick in bed while there, when his little pet ape suddenly jumped upon his head. He thought that some rats had probably frightened the little animal, and tried to tranquilize him, when several negroes shouted to him to get up, because the ants had entered the house. He was then obliged to be carried into the garden in order to save his life, for the ants had already commenced crawling on his feet, and the floor of the room was covered with them to the height of one foot. Those ants, he relates, ate up every living object within their reach; and of one cow, which was accidentally left over night in the stable through which they passed, nothing but the bones were found the next morning.

The VISITING ANTS (*Formica cephalotes*), which inhabit the tropics of America, are not less destructive in their ravages, although not as dangerous as the African species. They are as large as a common wasp, and chestnut colored. Once every year they issue from their subterranean abodes in innumerable swarms, enter the houses, run through all the rooms, and kill all the large and small insects that are to be found therein—such as scorpions, centipedes, spiders, as well as lizards and toads. Not only these small animals, but even the human inhabitants of the houses, are obliged to flee before them; and yet they are quite welcome, and are not disturbed in their progress, for these ants thoroughly clean a house of all vermin, and as soon as they have accomplished this they leave it for another dwelling, through which they pass in the same manner. The insects,

also, are of the greatest use in the tropics, because they so rapidly devour noxious carrion, which, if allowed to remain until its decomposition and evaporation, would speedily cause a pestilence. Their superabundance, which would be dangerous to human life in the tropics, is checked by different species of ant-eaters and armadillos in all the tropical regions of America, Asia, and Africa. These animals feed exclusively on ants, and are unquestionably the instruments which a kind Providence has created for the purpose of limiting the increase of these voracious insects.

But our limits forbid us further to pursue this subject, and we, therefore, shall now conclude our history of the Hymenoptera with the consideration of the most interesting genus of the order—in fact, the most interesting, and in many respects the most useful, of all the insects that inhabit the globe, viz.,

The Honey-bee (Apis mellifera).

This is an insect that in every country has universally attracted man's attention and his nurturing care, from the earliest ages of the world to the present time—a little animal that has, probably, excited more admiration from all classes of men than any other animated being on the earth's surface not of the genus Homo—an insect celebrated in the most ancient as well as the most modern records of the world, both sacred and profane, as a riddle to the learned, a marvel to the scientific, a faithful servant to the ignorant, who has only known that it would ten-fold reward his care, an object of wonder and reverence to the superstitious and the heathen, and a model lesson to the child! Even in our nursery rhymes it has been distinguished above all other animals as an example of industry, and the little lisping child is taught to sing

“How doth the little busy bee
Improve each shining hour!”

The most exalted and the purest minds that have ever drawn their moral illustrations from the works of Nature have singled out this little creature as a wonderful and convincing evidence of the design and handiwork of a God. One distinguished writer truly says: "That within so small a body should be contained apparatus for converting the virtuous sweets which it collects into one kind of nourishment for itself, another for the common brood, a third for the royal, glue for its carpentry, wax for its cells, poison for its enemies, honey for its master; with a proboscis as long as the body itself, microscopic in its several parts, telescopic in its mode of action, with a sting so infinitely sharp that, were it magnified by the same glass which makes a needle's point seem a quarter of an inch, it would yet itself be invisible, and this, too, a hollow tube; that all these varied operations and contrivances should be included within half an inch of length and two grains of matter, while in the same 'small room' the 'large heart' of at least thirty distinct insects is contained, is surely enough to crush all thoughts of atheism and materialism."

But whatever reflections the examination of their wonderful life and history may excite in the minds of observers, certain it is that, either as pure natural curiosities, or on account of the profit that may be derived from them, bees have ever been the subjects of much research and investigation on the part of practical agriculturists as well as scientific entomologists. We find works descriptive of them, and the manner in which they should be treated so as to make them most productive, in all languages, ancient as well as modern; and the number of works written on this single species of one genus of insects is greater than those published on any complete genus or order in entomology.

Among the scientific works on this subject we may particularly refer to those of Swammerdam and Reaumur, published about the middle of the last century. The former,

in his "*Biblia Naturæ*," gives his minute anatomical investigations of the external and internal parts of the bee, while to the latter we are indebted for some of the best observations concerning bees, published in the fifth volume of his "*Histoire des Insectes*." The works of Mr. Huber, of Geneva, in Switzerland, "*Nouvelles Observations sur les Abeilles*," 1814, as well as the "Treatise of Bees, by Robert Huish, London, 1815," are both very rich in new observations concerning the history and treatment of these insects. The excellent work of the last-named author can not be too highly recommended, and should be in the possession of every apiarian.

It is probably on account of their great utility, more than because of the wonderful phenomena which they exhibit, that bees have always received so much attention from mankind in general. While we are at no great expense for their food, they furnish us with a precious and lucrative luxury, and, except the silk-worm and cochineal, they are the only insects of direct commercial value to man. In comparison with the silk-worm and cochineal, the bees occupy a superior rank, and are more generally beneficial to man, because they prosper in all climates, even where the former can not live. In those old times before the process of making sugar was known, and for a long time after in countries and among classes of people that could not procure it, bees were much more important because of their honey. On this account, so much care was bestowed upon them in ancient times, as is related by Cato, Varro, Columela, Palladius, and Virgil.

The great importance of these insects, and the interest universally manifested in them, demands from us a tolerably minute description of their natural history, as well as the best modes of treating them, so as to make them most productive.

It is impossible for any reflecting person to look at a bee-

hive in full operation without being astonished at the activity and surprising industry of its inhabitants. We see crowds constantly arriving from the woods, meadows, fields, and gardens, laden with provisions and materials for future use, while others are continually flying off on similar collecting expeditions. Some are carrying out the dead, others are removing dirt or offal, while others are giving battle to any strangers that may dare intrude. Suddenly a cloud appears, and the bees hurry home, thronging at the entrance to the hive by thousands, until all are gradually received within their sacred inclosure. In the interior of the hive we see with what skill they work their combs and deposit the honey which they have manufactured; and when their labor is over for the day, we observe them resting in chains suspended from the ceiling of their habitation, one bee clinging with its fore feet to the hind feet of the one above it, until it seems impossible that the upper one can be strong enough to hold on to the ceiling and support the weight of so many hundreds, without letting them drop. But all these circumstances will be mentioned in their proper places; and, for the purpose of presenting our readers with a complete history of this most interesting species of insects, as well as with correct ideas of their proper management, we propose to explain in order:

- 1st. The different individuals of which a bee-hive is composed;
- 2d. The different kinds of bee-hives;
- 3d. The laying of their eggs;
- 4th. The development of the egg;
- 5th. The swarms;
- 6th. Their sting, and battles;
- 7th. The collection of honey and wax;
- 8th. The combs;
- 9th. The honey harvest;
- 10th. The uses of wax and honey.

First, then, every bee-hive is composed of three different individuals, viz. : one female, called the Queen Bee, who is the sovereign ; a number of males called *Drones*, who represent the peers ; and a large number of working-bees, which are also females, but of an imperfect organization.

The Queen Bee has a slender body, armed with a sting, and very short wings. The drones are larger and thicker ; they have long wings, but no stings, and consequently are harmless. The working bees are smaller than either, but are by far the most numerous ; in a large hive, their number is not unfrequently from twelve to fifteen thousand, and sometimes more. They are the proletarians in that monarchy, and their business is to nurse the young ones, to build the combs, and to collect the pollen and nectar of flowers, with which they prepare their honey and wax. All these materials which they collect they carry home in their fossa, a spoon-like excavation in their hind legs. They, like their queen, are armed with a sting.

The Queen Bee is not only the sovereign, but also the mother of the hive, and it is probably because all look to her as the only one capable of propagating the race that she is held in such high estimation. Her progeny is enormous, for she lays eggs to the number of several thousands. But who is the father of this immense brood has been a question of dispute for ages, and is still not satisfactorily settled. Naturalists have always supposed the drones entitled to the parentage, as they are the only males in the establishment ; but Reaumur, and many others who have indefatigably watched the manœuvres of the Queen Bee, both night and day, have never yet been able to detect her in any act of copulation. The queen has even been confined in a glass hive with the drones, separate from the workers, but no intercourse took place, and all died a few days afterward. Huber gives as his opinion that the queen has intercourse with the drones when taking flight with them in

the air; but this can hardly be possible, because the queen is constantly occupied in dropping her enormous number of eggs into the cells, and has no time to fly out; besides she is not able to make flying excursions, because her wings are too short, and her body too heavy. It is, moreover, not a little absurd to suppose that Nature should have placed one female at the disposal of a thousand males, who, in order to gain her favor, would quarrel and murder one another until the whole colony would be destroyed. We must conclude, then, that her majesty the Queen Bee deserves to be titled the Virgin Mother and Queen of the Bees.

But the eggs of the queen, after they have been deposited by her in the cells, are probably fecundated by the drones, in the same manner as the male fishes fructify the spawn. To this opinion is objected the fact that the drones are massacred by the working bees every autumn, and if so, how can eggs laid in the spring be fecundated? We answer, that we have never seen a hive, even in winter, that did not contain drones, and if we had, there is no reason why they could not have fecundated the empty cells previous to their death. At all events, it is conceded that the drones, being the only males, are the only agents connected with the hive that are capable of fructifying the eggs, whatever be the process by which it is done.

The drones are larger than the working bees and have a rounder head. They are called by the French "Bourdons," because they hum louder than the others, and they are visible only from the beginning of May to the end of July. Their number is about ten or twelve times less than that of the workers, and their chief business, as we have said, is to fecundate the eggs which are deposited in the cells by the queen.

It was known in ancient times that a large bee with a long body and short wings existed in every hive, and it was called the King of the Bees, and to him was attributed the

highest degree of wisdom in governing and managing the different inhabitants of the hive. This opinion was universal until about one hundred and fifty-six years ago, when Swammerdam, by a series of profound anatomical investigations, proved that this so-called king was a female, which lays all the eggs necessary to the growth and multiplication of the society she governs, and which accordingly is now called the Queen Bee. Aristotle and Virgil held the opinion that this bee lays no eggs at all, but only brings home some substance from the flowers and fruits, from which the maggots originated. This opinion, also, was proved erroneous by anatomical investigation; and to prove its falsity it is only necessary to open the body of the Queen Bee, when several thousand eggs will be found within her.

The best way of making the acquaintance of the Queen Bee is to divide a new swarm, and put each into a separate hive. The one which is in possession of the queen will soon be contented, and then she can be seen running about at the bottom of the hive entirely alone; but after a little time about a dozen of the working bees will surround and accompany her, and their number will gradually increase. Some approach her and are caressed by her proboscis, while others offer her honey with their proboscis, and she licks it off. Reaumur, having divided a swarm in this manner, says that the smaller one, with the queen, worked very negligently for several days, and then swarmed with the queen and placed themselves upon a twig of a tree, probably because their number was too small to promise a large progeny. After he had put them into the hive several times, they went off again, and finally united with the bees of a neighboring hive, where they were all massacred. The other swarm, without a queen, seemed to be satisfied at first, several of them going out the following day, but returning without bringing home any provisions or materials. They remained in this condition six days without making a

single cell, and in three weeks, without having accomplished any work, the greater part of them flew away, while the one thousand which remained were found dead in the hive the next morning. This experiment was repeated several times, but always with the same unhappy result.

From these and such like experiments we are convinced that they do not work if their number is not sufficiently large, or if they have no queen, and therefore that the object of their labor is to rear and provide for a numerous progeny. If in the spring we observe bees returning from the meadows and gardens with empty fossæ, and if we ascertain that no new combs have been made since winter, we may be certain that the queen is dead. Every day less and less bees return to such a hive, and by the month of June scarcely one thousand can be found in the hive. They perish, or they try to smuggle themselves into another hive, where they are generally killed.

In order to prove that the bees always follow the queen, Swammerdam fastened a hair on her foot, and tied it to the top of a pole, which he stuck in the ground in his garden. The whole swarm immediately followed, and surrounded the queen on all sides. In this manner he was able to carry the whole swarm any where he pleased. Labet relates that he found, in his travels through Western Africa, a man who called himself the Lord of the Bees, because they constantly followed him, flying about him wherever he went, alighting on his cap, face, shoulders, and hands, without stinging him. The people thought that he had rubbed himself with some plant or substance that prevented their stinging him; but the secret of all these manœuvres probably consisted in his carrying a queen concealed in his cap or elsewhere.

It is not their admiration for the queen's beauty or esteem for her rank that makes the bees follow her and minister unto her wants, but rather their attachment to the individual which produces eggs, and from whom they expect

a numerous progeny. If, for instance, some hundred bees are taken from one hive and transferred into an empty one, they are at first very unruly, but as soon as a strange queen is put into it they collect around her, as if about to celebrate a great holiday; they lick her for hours, press themselves close around her, creep under her, lift her up and cover her on all sides. Soon after they fly out, collect materials for wax, and in the first twenty-four hours make a comb about the size of a half-dollar piece, without paying the least attention to the hive from which they were taken, even if it is near by. Such small colonies, however, never prosper, but soon emigrate with their queen and perish.

If a queen and some of the working bees are thrown into water until they are nearly dead, and are then brought into a warm place, the latter, as soon as they recover from the shock sufficiently to move, begin to manifest their anxiety for the queen, and endeavor to restore her to life by licking her; and as soon as she moves a limb a cheerful huzza is expressed by a general humming. The bees show a similar affection toward every queen without distinction; even if two strange queens are put into a full hive, a crowd immediately collects around them and begins to hum, and soon the humming becomes general throughout the hive.

This fact does not seem in consonance with the common opinion that only one queen bee is permitted in a hive, which is undoubtedly true; but then it must be remembered that the reason why they can not live together is only on account of the persecution of the legitimate queen, because the bees have no other desire than to people their hive as quickly and as much as possible; and in this instinct teaches them right, for a thickly-peopled hive will endure the coldest winter, while one that contains but a few will perish for want of the necessary higher temperature produced by them. But if there is more than one queen in a hive, these two ladies settle their pretensions to the throne by single combat,

while neither their coward peers nor the proletarians will interfere, they being indifferent who is at the head of their government, except that, according to the law of their nature, they must have a female sovereign. It is, therefore, a fixed fact that in their female monarchy the bees have love for nothing else except for their progeny, and that they work not only for their own subsistence, but more even for that of their successors and descendants.

2. THE DIFFERENT KINDS OF BEE-HIVES.—As wild bees, in the forests of all countries, make use of hollow trees for their dwellings, it was natural that the persons who first domesticated the bees should imitate them in the construction of their habitations. Accordingly, the first bee-hives were made by hollowing out the trunk of a tree; and such rustic bee-hives were still in use thirty years ago, when we traveled through Hungary and Poland. We found them also in the Ukraine and Russia, where a single proprietor had from three to four hundred such hives fenced in, and under shelter in some open space in the forests. A handsome income was there derived from these animals, their food costing not a single farthing.

Another kind of hive, in shape like a bell, and constructed of willow boughs, or more commonly of straw, is frequently seen in Germany, France, and Great Britain; but they are very inconvenient on account of the difficulty of taking out the honey without destroying the bees. It is true, however, that straw-hives will best protect these insects from the intense heat of summer, as well as from the great cold of winter.

Bee-hives in the shape of an oblong box, composed of four boards with a movable top, are very common in this country, and are more convenient than the straw-hives, for taking out the honey and wax, which is done by removing the cover and placing over the box an empty one of the same size, inverted so that both open tops shall come togeth-

er. If then the lower box be gently beaten with a stick, the bees will ascend to the upper one, and the box containing the honey can be removed and emptied at pleasure, without any destruction of the bees. But these boxes must not be exposed during the winter, or its inhabitants will perish of cold and hunger.

Within the past few years great improvements have been made in the construction of hives, both in Europe and in North America. Among the Europeans, the hive of Professor Huber, of Geneva, occupies the first rank; but there are many others in use which are described by Robert Huish, in his "Treatise on Bees," and also in "The Naturalist's Library."

Among the many patent hives of North America, we feel justified in recommending the "Platform Bee-hive," invented in 1853 by Sylvester Davis, of Claremont, New Hampshire. At the "Exhibition of the Industry of all Nations," in the Crystal Palace at New York, this hive received the medal for its ingenuity and practical utility in the keeping of bees. The Committee of the Ohio State Board of Agriculture, also, awarded a silver medal and diploma to the inventor; and they spoke in special terms of commendation of the combined merits of this hive, the invention of which has reduced the matter of keeping bees to a system, which vies with the manufacture of honey by the bees themselves. This hive has also taken the first premium at the State and County Fairs in Vermont, New Hampshire, Massachusetts, Indiana, and Ohio, and justly so, for with it any one may keep bees with perfect safety and success, since all difficulty and uncertainty are entirely removed. With it the bees may be made to swarm from one or more hives, or may be conducted into any one hive without swarming, and still have a full supply of queens, while all the bees are entirely protected from the bee-moth, and other insects which annoy and ruin them. The work and prog-

ness of the bees, also, may be seen in the hives, honey-boxes, and feed-drawers, and each step of their development may be watched. Mr. Davis, also, has a preparation with which to feed the bees in winter and spring, which costs about three cents a pound, and another kind of food, composed of seven different articles, which he uses after the blossoms disappear, and which costs from five to six cents a pound. This Platform Bee-hive, with a book giving full directions for making the hive, feeding and managing the bees, may be obtained for \$10 of the inventor, S. Davis, Claremont, New Hampshire.

According to the Report of a Committee of the New York Agricultural Society, at Albany, September 3, 1850, the profits of nine swarms of bees that were fed were \$383 75; while in 1854 Mr. Davis, with his preparations, fed five swarms of bees, at a net profit of \$75 a swarm; showing a great advantage either in the feeding or management of the bees.

In order to observe the operations of the bees in a hive at least two sides of it must be of glass, covered with shutters which can be opened at pleasure. In this way it will be seen that the combs form perpendicular and parallel walls, with intermediate spaces, or streets, wide enough for two bees to pass one another. Each comb has cells on both sides, with here and there passages through the comb, which give the bees much shorter and speedier access from one side to the other. But this internal construction of the hive is subject to many irregularities, because the bees always accommodate themselves to circumstances.

It was formerly thought that the cells were the habitations of the bees, because they are seen so constantly putting their heads into them; but this is not so; they do this either to fecundate the eggs, or to put honey in them, or else they are feeding the young ones. On account of their multitude, it is almost impossible to observe the operations of

one bee for any length of time, for it soon escapes the eye and is lost among the crowd, until it seems as if all were in the greatest confusion and disorder. This, however, may be partially avoided by marking one or more bees upon the neck with a solution of sealing-wax in alcohol.

3*d*. THE LAYING OF EGGS.—The Queen Bee resides in the interior of the hive, between two combs, and has no other business than to deposit an egg in each empty cell, which is done very quickly, and principally during the months of April and May. The egg is oblong, white, and fastened at one end to the bottom of the cell. During the season of laying the eggs the bees work with indefatigable industry in order to furnish the necessary number of cells; and so fast do they accomplish their task that a comb nine inches long is often built in one day, and yet, notwithstanding this rapidity, the queen is often obliged to deposit her eggs in half-finished cells. When thus occupied in discharging the grand function of her life, she marches with great dignity, always accompanied by a dozen or more of her subjects, like the Virgin Queen with her courtiers.

We may form some estimate of the enormous number of eggs which the queen lays, from the size of a swarm which leaves the parental roof in May or June. Such a swarm will number about twelve thousand, and the eggs from which they came were laid in the preceding months of March or April; but still the queen continues laying, and we may obtain one or two more swarms from the same hive during the summer. Each queen lays a few eggs from which proceed queens, and from seven hundred to a thousand eggs from which proceed drones, while all the rest will produce working bees.

4*th*. DEVELOPMENT OF THE EGG.—The egg is fastened by one end to the bottom of the cell, so that it looks as if it were suspended in the air. It is soft and smooth, and is five times as long as it is thick. It was formerly believed

that these eggs were developed slowly, being hatched by the drones, but this is now proved to be impossible, because bees are cold-blooded, and that process would be useless, while the temperature in a hive is as high as that under a brood-hen. The eggs are first developed into maggots which are scarcely able to move: they have a mouth like a caterpillar, two white eyes, and ten air-holes, which are their respiratory organs, on the sides of the body. They are fed with honey by the workers for about a week, after which time their nurses make a wax cover over the cell, and inclose the maggot within, which then becomes a pupa, remains ten days in this condition, and then breaks open its wax cover, creeps out from the cell, dries its wings, runs about over the combs for a while, and then flies away out of the hive in company with its companions to collect materials and provisions for the hive.

5th. THE SWARMS.—Of the immense number of eggs laid by the queen, those of the workers are laid first, then those of the drones, and at last those of the young queens; and as the eggs are developed into perfect bees as often as every four weeks during the season, the new progeny, with a young queen at their head, swarms—that is, they leave the hive, and become the founders of a new colony. This emigration principally occurs during the months of May and June, and between 10 o'clock A.M. and 3 o'clock P.M. They issue in such crowds that the air looks as if filled with snow, and, flying about for a while, finally settle themselves upon the limb of a tree, crowded close together, and hanging one upon another in a lump, which resembles a long and bushy beard. It is, therefore, the best plan to have no high trees near the apiary, for if the swarms are obliged to fly high up before they lodge on the tree they are frequently lost. In such a case some people throw up fine sand into the air, which affects the bees like rain, and makes them descend. In some places they drum with iron upon tin pans,

brass kettles, etc., to make the bees swarm, because it was observed that sounds imitating thunder make them hasten home.

After a swarm has alighted and hangs from a limb, it must gently be placed in an empty hive made ready for that purpose, the inside of which is to be perfumed with some aromatic plant, as lavender, or mint, etc., and then left in a shady place upon the ground until after sunset, when it may be removed to its destined place in the apiary. But if a swarm should happen to settle within a hollow tree, it must be drawn out during the night with a long and flat stick, and then placed in the hive.

It sometimes happens that there are two queens in one swarm, which then separates into two very unequal lumps, one perhaps as large as a man's head, and the other about the size of an orange; but the two often unite again, even at the expense of one of the queens. Reaumur had a swarm with three queens, which he placed in a hive. The first and second day the bees seemed to be contented, but very inactive; the second day one of the queens was found dead, and on the following day another, and then for the first time the bees began to work. This is the case with all such swarms; the supernumerary queens are always killed, for these unhappy creatures can not, like human sovereigns, find a safe asylum in foreign countries, but are always murdered by their rivals.

Swarms differ in size, according to several circumstances that have been already mentioned; some will weigh only four pounds, while others will weigh from eight to ten pounds, or even more. A good swarm weighs generally from six to eight pounds, and the weight, of course, is ascertained by weighing first the empty hive, and afterward the full one. If the bees are satisfied with the hive, and have been properly swarmed, they soon ascend to the upper part of it, and in course of two days will make a comb

more than a foot long, and four inches wide, before they fly out, which fact is regarded as a proof that they produce wax from their own bodies, without having ever collected any of the pollen of flowers or other materials for that purpose. If the weather is fine, they fly out on the third day for the purpose of collecting their materials, and in twenty-four hours after a comb may often be seen, twenty inches long, by eight inches wide; and in five days half of the hive will be filled with combs.

6th. THEIR STING AND BATTLES.—The proboscis of mosquitoes and horse-flies forms their venomous weapon of defense; but this member is entirely harmless in the bee, while their sting, which is found at the hindmost extremity of their bodies, is much more formidable, and in its construction is somewhat remarkable and deserving of notice. If a bee be taken by the neck between two fingers, or, what is safer, between the blades of a pair of forceps, it will bend itself toward the part where it is held, and repeatedly dart forth its sting for the purpose of inflicting a wound. If the hind body be pressed in the same manner, the sting will be forced out, and although it is very thin, it may readily be examined with the naked eye, and a small drop of venom will be seen at its extremity, which is proof that it is hollow. With the further assistance of a magnifying glass, we find that this sting is composed of four parts, like bristles united together, of which the two internal ones are armed with a hook. These four bristles are all inserted in the wound made by the sting, which is thus formed into a hollow tube, filled with clear and fluid venom, which proceeds from a small bladder at its upper part within the body. Hence if a bee is suddenly driven away as soon as it has stung a person, the whole of the sting remains in the wound, retained by its hook, and with it also remains the venom-bag, with some of the entrails, on account of which the bee loses its life. All this may be witnessed by forcing a bee

to sting a piece of leather, and suddenly withdrawing it, for the sting will remain upon the leather, and with it a long filament of intestine, with the venom-bag.

That the pain and swelling of the wound of the honey-bee arises not from the sting alone, but rather from the venom, may easily be proved by any one who will prick his finger with a fine needle (the wound of which he knows will occasion very little pain, and will soon heal up without tumefaction), and insert into the wound only a small part of a drop of the venom of the bee, when he will soon find the pain and swelling as great as if stung by the bee itself. A member of the French Academy, who would not believe in the strength of this venom, inoculated a large drop of it into his arm, and in consequence was convinced of his error by terrible and excruciating suffering. Another proof of the influence of this venom is the fact that the sting of bees is comparatively insignificant in winter; while it is worse in summer, when the heat increases the quantity of venom: the same also as is the case with venomous snakes.

Reaumur allowed a wasp to sting him, and although at the expense of much pain, he waited until that insect had withdrawn his sting, when one of his servants, at his request, was soon after stung by the same wasp and experienced very little pain; immediately after Reaumur was again stung by the same insect, and felt no pain at all, probably because its venom had become exhausted, and in spite of all his irritation he could not make the wasp sting for the fourth time. Swammerdam made many such experiments with bees, and even put their venom upon his tongue, whereupon he experienced at first a sweet taste, which soon became acrid and caustic, and so continued for several hours. As blue litmus paper is not reddened by this venom, it is supposed not to contain acid; but its chemical nature has never been satisfactorily determined. Olive-oil and vinegar have been recommended as remedies for the

pain and tumefaction caused by the venom of bees ; but cold water or spirits of hartshorn (volatile alkali) is perhaps the best application after the sting has been extracted. This latter remedy we have often proved, and always carry a phial of it when making entomological excursions ; we have found it universally successful in relieving the effects of the sting of bees, wasps, mosquitoes, and snakes, particularly in tropical countries. Laudanum, or onion-juice mixed with salt, is also an excellent remedial application.

The stings of bees are their weapons of offense as well as of defense ; with them they fight their battles, murder their rivals, and massacre the drones. During the autumn and winter the drones are a useless burden to the community in the hives, as they do not work, and could only remain idle consumers of the honey which the working bees have manufactured and stored up for their own use ; hence they are murdered by wholesale every autumn—the workers killing them with their stings. In this respect they are not unlike the ancient Spartans, whose laws allowed them to kill their children if they were deformed ; or the Chinese, who are permitted to destroy each new-born infant that they deem themselves unable to support ; or the savages, who believe it their religious duty to kill all the superannuated or infirm among them, and thus put them out of misery.

Besides this annual massacre of the drones, the working-bees fight battles among themselves in the hives, where one throws herself with great fury upon another ; then, coming out of the hive, they fall to the ground, and wrestle together head to head, continually trying to sting one another, until at last one or the other succeeds in thrusting its sting between two ringlets, or into the head of the other, and thus kills her. Very often, however, the sting of the victor remains in the wound of the slain, and, if so, she also soon perishes. Such a battle sometimes continues only a few minutes, while at others it lasts for hours before the fatal

victory is won. Aristotle mentions the fact that in his time horses were stung to death by bees, and such instances have also happened in modern times ; so that it is actually dangerous for little children to have their playground too near an apiary. Like the ants, also, the bees consider the inhabitants of other hives as their enemies, and wage deadly war upon them whenever they come in contact ; so that if a swarm loses its way and enters a full hive a murderous battle ensues, sometimes lasting a whole afternoon, or until not a vestige of the enemy remains.

There was formerly some dispute as to whether or not the queen bee was armed with a sting like the workers. It is true that she is very quiet and peaceable, not so much disposed to fight as the workers, and will even run upon the hand without inflicting any wound ; but as soon as you touch her, or she is in any way irritated, she will dart out her sting at you, and its venom is as strong as that of the others. With it, at all events, she kills all her rival queens.

7th. THE COLLECTION OF WAX AND HONEY.—In order to understand the *modus operandi* of this the principal occupation of the bees, it is necessary to become acquainted with the instruments with which they work. The head of the bee is covered with hair, which is completely powdered with pollen when the head is thrust into the open blossom of a flower. On each side of the head are two oblong eyes, and above and between them three small stemmata, or coroneted eyes, arranged in the form of a triangle, while a little below are two antennæ, probably the organs of hearing. Below these are two horny jaws and their proboscis. The neck, trunk, or thorax, is united to the head by a thread-like ligament, and to its upper part are attached four wings, while from its under part proceed six legs. The hind body, or abdomen, consists of six scaly ringlets, and is attached to the thorax by a slender ligament. With regard to their legs, it is necessary to know that their fore

feet are used in the capacity of hands, with which they collect the pollen, brush it from the head, move it along to the second pair of legs, and thence to the hind legs, which are much longer than the others, and upon each of which is a small triangular cavity, shaped something like a spoon, and hence called a *fossa*, which is destined to receive the pollen of flowers, which they thus carry to their hives, for the purpose of furnishing food for themselves and the drones, and for the manufacture of wax. Humble-bees have similar baskets, or *fossæ*, in their hind legs.

It was formerly supposed by many, even by some distinguished naturalists, that the bees were blind; but so absurd an idea can easily be proved erroneous by covering their eyes with thick varnish, when, being unable to fly around, they rise perpendicularly in the air and disappear, in the same manner as does a crow, to which a bait besmeared with bird-lime has become fastened on its head.

Notwithstanding the ingenious Francis Huber, of Geneva, tried, by several experiments, to prove that the wax proceeds from the honey, and not from pollen, still the previous experiments of Reaumur, as well as those of some of the most experienced apiarians since, have distinctly demonstrated the contrary, as is also stated in the "Treatise on Bees, by Robert Huish, London, 1815." Reaumur says that the bees collect the substance of wax only from flowers, filling their *fossæ* or leg-cavities with farina, and licking from the bottom of the blossoms the nectar, or sweet substance, which they swallow, and afterward disgorge it into the cells. But in the same manner they also gather from other vegetables a viscous substance, which they carry home in their *fossæ*, and with this gluey matter, collected from the poplar, birch, willow, fir, and other trees, and the farina they compose a glutinous aromatic substance called *propolis*, which is similar to wax, but different in its fabrication; in fact it is wax, but coarser in its constitution. The

bees use it to close all the crevices of their habitation ; they also cover the bodies of interlopers with it, such as large insects, snails, etc., which enter the hive, and whose bodies are too heavy for them to carry out ; and with this substance, also, they glue their combs to the side walls of the hive.

The distinguished apiarian, Huish, speaking of the propolis, says, " It is a resin, soluble in spirit of wine and oil of turpentine. Independently of the use to which it is applied in medicine as a digestive, it has been discovered by experiment that, dissolved in the above solvents, it forms an excellent substitute for the varnish which is used in giving the color of gold to silver, or to tin made into foil. If, for example, it be incorporated with mastic or sandarac it would be excellent in the gilding of leather, etc."

The pollen of flowers, called also farina or ambrosia, and erithace and cerinthe by Pliny, is, as may be daily demonstrated, the real food of the bees, and therefore deserves the name which has been given to it, of bee-bread. This dust, which is found on the top of the stamens of all flowers, and which the bees collect and transport in their fossæ to their hives, is their real food and nourishment, and also the real material from which they manufacture both the propolis and the wax.

But how these little creatures transform the pollen into wax is a very different matter, and a question which has puzzled the most learned naturalists from the time of Aristotle, 300 B.C., to the present century. It is true that there are trees and shrubs which furnish a wax-like substance ; for instance, the wax-tree, or bayberry (*Myrica cerifera*), found in all our Northern and Southern States, from the berries of which we obtain, by boiling them, a green waxy substance, which is used for making candles, and of which berries one pound will make two ounces of wax ; but from the pollen of flowers no one has ever been able to make any kind of wax. If bees, returning from their excursions to

the hive with bee-bread, are caught with a bird-lime twig, and examined with a powerful magnifying glass, this farina, which they carry in their fossæ, shows no difference from its former condition, when on the stamen. If it is held, in a spoon, over the fire, it will not melt as wax does, but, on the contrary, will burn to ashes.

It was at one time believed that the pollen, mixed with the honey, or the venom of bees, would produce wax; but all the experiments made in this manner, or for this purpose, proved a failure. The pollen must, therefore, undergo a chemical change within the body of the bee before it can become wax; and, in order to make the latter from the former, it is necessary that the bees swallow the pollen, when it is manufactured into wax within their stomachs. According to Reaumur, it is then disgorged by the mouth as wax; but, according to the observations of Huber and other apiarians, the wax comes out in little scales from the abdomen, between the ringlets. This latter opinion is considered the correct one, and is now well established by observation and experience; so that the questions, whether the wax is made out of honey or out of the pollen, and whether the wax is disgorged from the mouth or detached from between the ringlets of the hind body in the form of little scales, seem to be now entirely settled among the most learned entomologists and apiarians.

The third article which the bees collect is honey, with which they fill the cells. We have already mentioned that this substance is obtained from the bottom of the calyx, or from the nectaries of flowers. Honey, with the farina, forms the principal food of bees—the former especially, when the weather is unfavorable for their excursions out of the hive, and during winter, when they perish unless they have a sufficient quantity of this food in the hive.

The perfume, which is more or less contained in both the wax and honey, is derived from the pollen of aromatic

plants, particularly of those of the natural order *Labiata*; as thyme, mint, hyssop, lavender, sweet basil, catmint, marjoram, mountain-mint, sage, and many others. Besides these aromatic plants there are many others rich in farina; as the willow, apple, and pear-trees, strawberries, sun-flower, melons, pumpkins, cucumbers, Indian corn, buckwheat, golden-rod, and many others.

8th. THE COMBS.—The cells of bees are hexagonous, or six-sided in form, as may be readily seen in every comb; but it is not so easy to observe how they build them. While looking at the bees in a glass hive, it seems as if all were taking part in the construction of the comb at one time, and such a crowd is concentrated in one spot that nothing can be seen. Still it may be observed that they put on the wax with their jaws, and give it a form, commencing at the top or ceiling of the hive, suspending their combs from above, and fastening them with propolis.

9th. THE WAX AND HONEY HARVEST.—This usually takes place, in this country as well as in Europe, during the months of September or October. The manner of obtaining this important harvest is different according to the views and experience of different apiarians, but it is usually done either by suffocating the bees and taking all their products, or by driving them out into another hive, and then depriving them of a portion of their food, when they are allowed to go back into the hive. Many apiarians use the former method, and kill all the bees in the old hives, so that they may use the whole amount of wax and honey contained in them. This merciless and cruel treatment of creatures who do us no possible harm, but are really very beneficial to us, is sometimes resorted to as a matter of necessity; for instance, where the hives are old, or infested by the bee-moth, or when the apiarian uses bell-shaped straw-hives, from which the honey can not be extracted without danger of being stung, and of killing the largest number of the bees by the operation.

Although this method of operating is cruel, and, in the opinion of many apiarians, unprofitable, still there are some arguments in its favor. A well-experienced apiarian, at present in possession of twenty hives each one year old, assured us that he realized from every hive an average of sixty pounds of wax and honey, for which there is a great demand in the market, the wholesale price of the wax being one shilling, and of the honey two shillings per pound. He suffocates the bees of all the hives that are one year old, and takes out all the wax and honey, but does not disturb the new hives obtained in the preceding months of May and June, which are generally two swarms or hives from each old one. He was well convinced that by this mode of obtaining the wax and honey he experienced much less trouble, and more profit, than those who employed other methods, and besides the harvest thus obtained he was able to sell about twenty young hives every year.

M. La Grenée, a French apiarian, and a strenuous advocate for the suffocating system, says: "I have scrupulously perused all the writings on the subject: I have not only studied their theory, but practiced their different methods; but neither books nor experiments have been able to convince me that there is a more preferable method than that which I use, which is by suffocation." "In regard to the common or bell-shaped hives, every body knows that the principal part of the honey being placed at the top, the sticks, which are absolutely necessary to support the combs, are an insurmountable obstacle to the extraction of the comb in a neat and profitable manner, as those transverse sticks can not be taken out without great injury to the combs; and what person does not perceive that this operation must place the bees in a terrible state of agitation, and be the death of thousands, one half of which would perish by the stings, which they would bestow with profusion on their tormentors in spite of fumigation, and the remainder

by the honey, which would stifle them. I have always experienced very great trouble in extracting the honey-comb from a hive the bees of which have been smothered, for the sole reason that the cross-sticks could not be drawn out."

"In regard to those hives composed of stories, I allow that the deprivation of the honey is performed much more easily than in others. But is the proprietor always careful of the important circumstance of extracting only that particular quantity from the hives which will prevent the danger of famine? For, if the stories be small, and if, for fear of injuring the bees, he extracts but a small portion of their produce, wherein then does his advantage consist? On the other hand, if the upper stories be large, they contain perhaps the whole of the honey, and in taking that away the bees are consequently deprived of their winter food, and must inevitably perish. If, to avert this evil, the system of feeding be resorted to, the proprietor will be under the necessity of returning to the bees the honey which he took from them; and if the bees escape from a death by famine, they will inevitably perish by the pillage, which is frequently and almost universally occasioned by these artificial supplies of food.

It is evident that this method does not obviate the two principal inconveniences, which are so conspicuous; one of which is the entire loss of the hives during the winter, if a great quantity of provision be extracted from them; and the other is the paucity of supply to the public, and almost no profit whatever to the proprietor, if only a little be taken.

But let us calculate the produce of this method with that which is produced by the system of suffocation. We will suppose that a proprietor has ten hives: according to the removing system, they will furnish each twelve pounds of honey, which will amount in all to one hundred and twenty pounds; and the proprietor will possess twenty hives, ten old, and ten new ones. The sixty pounds of honey may be valued at £9, and the twenty hives at £20. According to

the suffocating system, ten hives will produce thirty pounds of honey each, which amount to three hundred pounds; and the proprietor will have twelve young hives—that is, ten composed of the first swarms, and two of the second and third; or, in other words, the honey will amount to £22 10s., and the hives to £12. In order to facilitate the calculation, I suppose that each hive gives but one swarm in the year. Now, although these two species of profit, as well in honey as in hives, appear to the two proprietors to amount to nearly the same sum in money, a considerable difference is still to be remarked; for, in the first case, the public profit only by one hundred and twenty pounds of honey for their consumption, and the proprietor has realized only £9 in money; whereas, in the second case, the public are put in possession of three hundred pounds of honey, and the proprietor has realized £22 10s. in money.

“Moreover, it must not be supposed that in the following years the benefit of the first proprietor will far exceed that of the second, by the greater multiplication of his hives: this would be tantamount to a voluntary concealment of the frequent and almost general mortality occasioned by the method of removing the bees from one hive to another, and which will indubitably reduce every year the great number of hives of the first proprietor to a number below that remaining to the second, by which we may be assured that the annual profits of the former, so far from being more considerable than those of the latter, will always be much smaller. This method, therefore, of removing the bees into other hives, after the departure of the first swarm, is neither advantageous to the proprietor nor to the public.”

Now, on the other hand, although the ideas of M. La Grenée may be founded in truth, and are the result of his practical observations, still others have had different experiences, and offer many arguments in favor of the mode he so

much deprecates. In the first place, they say it is inhuman and cruel to destroy so many precious lives, particularly where it is unnecessary and unprofitable; and, secondly, that if one is well acquainted with the management of bees, it will very seldom happen that a hive perishes by starvation or cold, and that the profits of the proprietor will rapidly increase by the method of deprivation, and by keeping the bees alive. Let us suppose an apiarian who well understands the management of bees has, to commence with, ten old hives; he may have by this method, at the end of five years, six hundred and thirty-six hives, if he chooses to keep so many, and may realize a profit of nearly \$1500, as illustrated by the following table:

Years.	Hives.	Pounds of Honey.	New Hives.	Sum of Hives.	Profit of Honey.
First.....	10	100	12	22	\$25
Second.....	22	220	26	48	50
Third.....	48	480	54	102	120
Fourth.....	102	1020	110	212	230
Fifth.....	212	2120	424	636	504

The idea of having an apiarium of six hundred and thirty-six hives may seem rather eccentric, and many, doubtless, would think that so large a number of bees could hardly find pasture enough for their support in any one section of Europe; but in the immense territory of the United States there are many thousand acres covered with woods, and prairies abounding in odoriferous herbs and flowers, principally in the West, where the inhabitants would find this branch of industry, nowhere thoroughly attended to, a very easy and lucrative business. At all events, if it should be found impracticable to keep so many hives, still a very handsome profit could be realized every year from the sale of all the superfluous hives.

The usual method of removing the honey and wax, where it is intended to keep the bees alive, is the following: The full hive is turned bottom-side up, and a new

empty one of the same diameter is placed immediately over it, with a cloth around the centre where the two join, in order to prevent the bees from molesting the operator. The sides of the lower hive are then gently beaten with sticks in order to make the bees ascend to the upper one, which event may be ascertained by a loud humming noise, and soon the whole community will have gone into the new hive, and then may be removed to the apiary. Besides this method there are two others used to drive the bees from one hive into another, viz., by filling the hive with smoke or water. In the latter case there is little danger of killing the bees, for they are very hard to die by drowning; and often, after being in the water a whole hour, and taken out apparently dead, they will soon revive if they are placed upon a warm, dry sheet. By this latter process it may be more easily ascertained what is the number of the bees, and the condition of the queen, etc. If bees from several hives have been partially drowned and afterward resuscitated, they may all be put into one hive, and they will live peaceably together, provided only that there is one queen left with them—a new hydropathic remedy that might be employed with advantage, perhaps, in cases of domestic or national discords; so that, instead of granting divorces, or violently separating States, we would recommend this easy method of making hostile parties live peaceably together.

If either of these methods of depriving the bees of their wax and honey should be adopted, it may be done in the month of June, soon after the first swarm has left the hive, or it may be done in the month of October. The deprivation in the beginning of summer has this advantage, that you can take all the honey and wax from them, because the bees will have time enough during the summer and fall to store up food sufficient for their winter use, provided that the country affords good pasture for them. It has other advantages also, and important ones too. In the first place,

both the wax and honey are better taken at this season; and in the second place, you have an opportunity of inspecting the combs, to see whether the bee-moth has infested them, and to prevent this it is better to give the bees a new hive. If, on the other hand, the deprivation is effected in October or November, two thirds of the wax and honey must be left to the bees for their winter provisions; and hence it becomes necessary to ascertain the weight of the full hive before the operation takes place, in order to calculate the quantity of honey-comb which may be extracted.

It is surprising that, with the large profits which apiculture realizes from a very little capital and labor, so little attention has been paid to it of late years, and in this country particularly. It would seem that every countryman who possesses only a few acres, or even an ordinary garden, would have at least one bee-hive from which to raise honey for his own domestic purposes.

In some countries, it is true, this culture has the preference before all other agronomical occupations. It is said "that when the Romans became masters of the island of Corsica, they imposed on the inhabitants a tribute of wax which amounted to 200,000 pounds per annum. Supposing, therefore, that the island retained the same quantity for its own use, we have 400,000 pounds of wax made by these wonderful little insects on one island. It is well known that the proportion of wax to honey is about one to fifteen or twenty; multiplying, therefore, these 400,000 pounds by fifteen or twenty, we have six or eight millions of pounds of honey. What a source of riches for the island of Corsica, if the culture of the bee was carried on as formerly, especially since the price of honey and wax is so much higher now than it was then."

Apiculture is flourishing in Turkey, Wallachia, and Moldavia, from which places an immense quantity of wax is exported. In the small kingdom of Hanover, in Germany,

the annual produce of wax is estimated at 300,000 pounds, and of honey 4,500,000 pounds.

Wax is also an important article of commerce in Russia, of which a large quantity goes to England and France, for in both these latter countries very little wax is produced. In England apiculture is very much neglected; and Mr. Huish says, "Excepting the Spanish, I know of no nation which entertains such superstitious prejudices in regard to bees as the English. It will hardly be credited that in some parts of England the bees are not permitted to leave the hive on a Friday, and this is founded on religious scruples." The military despotism and tyrannical conscription which prevails in France is undoubtedly the reason why this branch of industry does not flourish there.

According to the statistical view by J. D. B. De Bow, in the year 1850, the United States of America produced 14,853,790 pounds of honey and wax, which is a small quantity in comparison with Hanover. It is, therefore, desirable that some measures should be taken for the encouragement of apiculture in this country, similar to those that have been adopted in other countries; for, although it is attended with some difficulty, we have a number of different patent hives which render the labor exceedingly easy in comparison with that of other branches of culture. "In Germany," says Mr. Huish, "it is actually made a part of education, and certain persons are appointed and paid by the government to instruct the peasants in the cultivation of bees. It is not only theoretically, but practically taught, and for this purpose alone gardens are kept containing nothing but bee-hives and their food, for the instruction of the peasants. Thus, in Vienna a bee-master has been appointed, who has a garden containing a hundred hives, which is provided with every implement and improvement necessary for the elucidation of the practical management of bees. Particular days are specified in which public lectures are

held in this garden; and it is generally frequented by young men intended for the clerical life, who are obliged to attend that they may be able to impart their knowledge to their future parishioners. A regular journal is kept of the proceedings of the establishment, which is open to the inspection of every one.

"There is a 'Patriotic Apiarian Society of Bavaria,' which is a most laudable institution, and its laws ought to be translated into the language of every country where bees are known. It is not permitted for a peasant to have his own apiary, but a particularly favorable spot is pointed out by the Society, in which the different proprietors deposit their hives. This place is under the management of a skillful apiarian, appointed by the Society; and it is ordained that no more than one hundred and fifty hives shall be kept in one place, and each establishment must be four miles distant. A trifling tax is levied upon each hive not belonging to the Society; and thus the peasant looks forward, at the end of the year, to a certain profit, with a very slight outlay, and without any demand upon his time or labor. Should a poor peasant wish to become the proprietor of one or more hives, he applies to the Society, who immediately accede to his wishes, and an annual deduction is made from his profits until the Society is repaid the value of the hives it has bestowed."

In many parts of Germany the peasants receive from the Government a florin for every hive which they rear during the season, and, to prevent their killing the bees, the florin is not paid until the spring, at which time it would be of no advantage to the proprietor to destroy his bees. So in this country the foundation of an independent Apiarian Society in each State, or, at least, its particular encouragement by the different Agricultural Societies, would greatly tend to the promotion of this interesting and useful branch of industry.

10th. THE USES OF WAX AND HONEY.—It need hardly be mentioned that both these are extensive articles of commerce, and as such are the means by which large sums of money are made every year. We are informed on good authority that Great Britain, where this branch of rural economy is quite neglected, annually imports more than four hundred thousand dollars' worth of beeswax. This article is extensively used in the manufacture of candles for lighting churches and palaces, as well as more humble dwellings; it is also used for polishing floors and tables. In anatomical museums it is used for the representation of every part of the body, and of almost every surgical disease or deformity; and to so great an extent has this useful art been carried in France and Germany, that medical students are spared the necessity of much disagreeable labor among the dead bodies, and many disgusting and dangerous investigations. The figures of distinguished persons are also modeled in wax, and painted to represent the life; so also are faces for doll-babies, and all kinds of fruit and flowers, natural as if growing on their native stock, made out of this substance which the little busy bee has manufactured for man.

Honey is a not less important article of commerce. Before the process of manufacturing sugar was known, it was generally used as a sweetening substance, and it is still extensively used for this purpose, as well as an ingredient of many medicinal compounds. The ancients pounded bees to a jelly, and used it as a beverage in maladies of the stomach and bowels, particularly in dysentery; they believed it removed freckles from the face, and, incorporated with nut-oil, restored lost hair. Honey was at one time thought to be a universal panacea: it dissipated melancholy, anger, corrupted blood; it cured inveterate coughs, pain in the side, and gout; it assuaged the troubles of the mind, restored the health impaired by age, etc., etc.

Many people in Germany and Hungary carry on an extensive trade in pastry, of which the principal ingredient is honey. The city of Nuremberg, in Bavaria, celebrated formerly as the principal manufactory of geographical maps and terrestrial globes, is now distinguished for the manufacture of all sorts of gingerbread and cakes (called *Nürnbergger Lebkuchen*), made of honey and flour, which are in great demand through all the cities of Germany, and are even exported to Russia. In the city of Presburg, in Hungary, among thirty or forty thousand inhabitants, we found at least a dozen pastry-cooks, each of whom, with their several journeymen, did nothing else but make small and large cakes in the form of a horseshoe, which were filled with pounded poppy-seed (*Papaver rheas*) mixed with honey. These cakes, of different sizes, weighing from half a pound to six pounds, are exported in quantities, and are known in Europe as the celebrated and delicious poppy-cakes (*Presburger Mohnkuchen*), which are commonly used as birthday, Christmas, and other holiday presents.

In Hungary, Poland, Russia, Prussia, and throughout Germany, a delicious, refreshing, and wholesome beverage is prepared from honey and water, which is called mead. There are three kinds—the simple, compound, and the vinous mead. The simple mead is made of honey and water, without undergoing fermentation; the compound is mixed with fruit, essences, etc., to give it a mixed flavor; and the vinous is the simple mead fermented.

Simple mead is made by boiling three quarts of water in which one part of honey has been dissolved: the quantity of honey may be augmented or diminished according to the taste of the persons who use it. It must be boiled over a moderate fire to two-thirds of the quantity, when the liquor is skimmed and poured into a barrel, taking care that the barrel is full: it is allowed to subside for three or four days, when it may be drawn off for use. This sort of

mead may be made more or less generous, according to the quantity of honey given to it, and forms an excellent stomachic. "In coughs it excites more expectoration, and is gently laxative." As an economical apiarian will not allow any part of his produce to be wasted, the linens which have been used for filtering the honey should be rinsed in the water destined for the mead. If the linen has been well saturated with the honey, the strength of the mead will be considerably increased.

To make the compound mead the following directions may be observed: During the time that the quantity of honey and water, as above, is boiling, some raisins, cut in two, must be boiled, allowing half a pound of raisins to six pounds of honey, and four pints of water are necessary to boil them properly. The liquor being diminished one half, it is strained through a linen, slightly squeezing the raisins, and is then mixed with the decoction of honey and water, and the whole is boiled together for a short time; a toasted crust of bread, steeped in beer, is then put into it, and, having taken off the scum which has formed afresh, the whole is taken off the fire and allowed to subside. It is gently poured into a barrel, into which has been put an ounce of salt of tartar dissolved in a glass of spirit of wine, particular care being taken, as before, that the barrel is quite full. It must then be exposed to the influence of the sun with the bung out, or in a chamber heated by a stove, keeping the barrel constantly full, until no more froth is emitted, when the bung may be fastened and the barrel put into the cellar, where it must remain a few months before it is fit for use. To render this mead more agreeable, five or six drops of the essence of cinnamon may be mixed with the spirit of wine in which the salt of tartar has been dissolved. Some pieces of lemon-peel, or the sirup of gooseberries, cherries, strawberries, or aromatic flowers, may be mixed with it, according to the palate of the fabricator.

This compound mead ferments a considerable time, and is preserved like the other. Care must be taken to rinse all the new barrels with brandy before the mead is put in them.

"To make the vinous mead, take one pound of honey to three pints of water. This is the beverage of the majority of the Northern people; they call it *miod*. The Russians, for example, compose their mead with honey, cherries, strawberries, gooseberries, and mulberries; they commence the fabrication by soaking these fruits for some days in clear water, to which they then add some virgin honey and a piece of bread soaked in beer. The barrels are placed in a room in which a heat of 18 to 25 degrees Reaumur is maintained day and night. The fermentation commences at the end of six or eight days, lasts for about six weeks, and ceases spontaneously. The common people of the same country make mead with honey which is not separated from the wax, and with combs in which the brood still exists; they beat these combs in warm water, leave the liquor to subside, strain it through a bag, boil and drink it."

Mr. Huish made an excellent mead in the following manner: "To thirty pounds of honey add forty-five bottles of water; the mixture is boiled in a great copper vessel, and when the liquor is reduced one half it is sufficiently boiled. Put two thirds of this in a new barrel well rinsed with brandy, and the other third into bottles closed with fine linen or coarse muslin. If in this state the liquor is tasted, it is insipid; and, in order to render it vinous, it must undergo fermentation, which imparts to it all the fumes of wine, and from which brandy, etc., may be made. In order to destroy more effectually the honey taste of this beverage, chalk, charcoal, and the white of eggs must be added in the following manner: the honey, water, and the chalk are put into a copper vessel, the size of which should be one third larger than the volume of the mixture, and the whole must be boiled for two minutes. The charcoal is

then put into the liquor and well mixed with a spoon, and the boiling is continued for two minutes more, after which the white of eggs is added, and the whole is then mixed with the same care as the charcoal, and it is again boiled for about two minutes; the vessel is then taken from the fire, the liquor is left to cool, and is then strained through a sieve or flannel.

“To excite fermentation the liquor must be exposed to heat. Two methods are practiced for this purpose: the first is to place the liquor in a stove, or the corner of a chimney, in which a constant fire is kept; some bottles are filled with the same liquor. In about seven or eight days the liquor emits a thick and dirty froth, which leaves a vacuum in the barrel which must be filled up from the bottles, which are also in a state of fermentation, which lasts about two months, and then ceases of itself. The other method is to expose the liquor to the sun; but in this case it must be done in the month of June, and left exposed until the fermentation ceases, which takes place in three or four months. On placing the barrel in the warmest situation, it must be raised a little from the ground, and attention must be paid to the bees and other insects attracted by the odor. During the heat of the day the liquor swells, the froth rises to the bung-hole, and runs down on each side of the barrel. Instead, therefore, of placing the barrel exactly horizontal, it is better to give it a slight inclination, taking the bung-hole as the parallel. As soon as the sun sets, or is obscured, the volume of the liquor is diminished, and the barrel has no longer the appearance of being full. In the first case the bees will lick up, without danger to themselves, the liquid which has flowed from the barrel; but in the second the bung-hole must be closed with a plate of lead pierced in holes; without this precaution the bees would drown themselves. The plate of lead must be taken off when the liquor begins to froth, and when the barrel is

no longer full enough to throw off the froth it must be filled up from the bottles.

"The fermentation having ceased, the barrel is put into the cellar, taking due precaution that it is full. After two or three years it may be put into bottles, which must be well corked, and allowed to stand one month to see if they do not burst. They may then be ranged in bins like other wines. The taste of this wine resembles that of Malaga; it is a great cordial, dissipates flatulence, and promotes perspiration. It must, however, be drank with moderation, as it is of a very intoxicating quality, and the intoxication caused by it lasts a very long time. The natives of Poland and Lithuania, whose principal beverage is mead, communicate a very agreeable odor to it by putting into the barrels a certain quantity of dried elder flowers, and so medicinal qualities may be given to mead by mixing with it the juice of different plants."

The wines of Malaga, Muscat, and some other sweet wines, are imitated in Paris by means of mead; but it is not difficult to discover this imposition, by taking a small decanter of glass and pouring into it the adulterated wine. If you stop the entrance of this bottle with your thumb, turn it upside down, dip it under water, and draw away your thumb, if the wine is spurious, the water will become cloudy, and the honey will be precipitated into it, while what remains in the bottle will be insipid water of an unpleasant taste.

Very good vinegar may also be made from honey, by dissolving half a pound in a pint of water, and exposing it to the heat of the sun, covering the bung-hole with a piece of coarse linen, in order to prevent insects from entering. In about six weeks this mixture will be excellent vinegar.

We have been thus minute in the descriptions of the common uses of honey, because every apiarian in the country should know how to use his products to the best advantage,

and because the mead manufactured for domestic use is both healthful and refreshing, and all who keep bees should know how to make it. "The laborer is worthy of his hire," and nothing tends more to the encouragement of domestic industry than the certain prospect of abundant reward. He who made all nature beauty to man's eye and music to his ear, also placed him in the midst of creatures whose lives are devoted solely to minister to his taste and gratify his palate, and thus for all his care and protection to return an exquisitely grateful and sufficient reward.

ORDER VII

TWO-WINGED INSECTS, OR FLIES—(*DIPTERA*).

THE insects of this order, as their Greek name imports, are creatures with two wings, which we commonly call flies. They are generally small, and we find among them some so diminutive that they can be seen only with a magnifying glass. Their bodies are divided into a head, thorax, and hind body or abdomen, which are connected together by a thin filament. The head consists of two large eyes, with an addition in some species of three small ones, and two short antennæ, very near together; below these are found, in some species, a soft proboscis, as in the house-fly; in others a hard, pointed sucking-tube, as in the mosquito; and in others simply a mouth. On the under side of the thorax are fastened three pair of feet, and on the opposite side one pair of thin, transparent wings, by the vibration of which they produce a humming sound when flying. The hind body consists of ten ringlets.

These insects are for the most part oviparous, only a few species being viviparous. Their maggots are white, of a spindle form, and without feet, but some of them have minute fleshy warts which answer the purpose of feet, and upon which they are able to move; they have two respiratory organs on the neck, and two on the hind body. Many of these larvæ live in the water, but the greatest part of them live in dirt, dung-hills, cheese, spoiled meat, fruits, etc. After a time the skin of these maggots becomes hard and brown, and thus they are transformed into a pupa, which in many species has the form of a barrel, from which afterward the perfect fly issues.

Flies are of very little use to man, and are generally deemed injurious insects, as many of them are able indirectly to kill even large quadrupeds; most of them vex us by their impudence, and torment man and beast by their stings and blood-sucking; while, in the maggot state, they even dwell in the skin on frontal cavities, or even in the entrails of some animals. So many dogs and other animals perish.

The number of genera of this order is immense, and far surpasses that of the lepidoptera. The most conspicuous of those found in the United States are the following:

The Gad-fly.

These resemble bumble-bees, and are sometimes known under the name of Bot-bees. These are two-winged insects, the females of which deposit their eggs upon the skin of animals, and their larvæ enter the body, and dwell either under the skin, or in the nose, or in the entrails. Of these there are several species.

The HORSE GAD-FLY, or LARGE BOT-FLY (*Æstrus equi*), has spotted wings, and a body covered with yellow hair. This is one of the principal flies whose young sometimes cause the death of a horse. The horse, which, among the animals useful to man, occupies the first rank, seems not to have been created for man alone; but even an insignificant fly usurps dominion over him, appropriates him to his own use as an article of food; so that while the horse is simply useful to man, he is really necessary to the existence of these insects, who can only live and develop in his stomach and intestines. The stomach of a horse is sometimes paved with these larvæ, or bots, as a street is paved with stones, and this, too, without the animal seeming to suffer by it. Formerly it was believed that this gad-fly deposits her eggs under the tail of the horse, and that the larvæ issuing from them creep through all the intestines until they reach the stomach; but investigations have shown this not to be the

case, but, on the contrary, as may be seen almost every day in spring and the beginning of summer, the female of this fly deposits her eggs, often five hundred in number, upon the fore-legs of the horse. In about four days these eggs are hatched; and as by their motions they produce a tickling or itching, the horse tries to remove them with his tongue, and in doing so swallows most of them, by which means they are transported to the stomach, where each one fastens itself, by means of two horny hooks, to the internal coat, there sucking its fleshy fibres and feeding on the gastric juice. When full grown, and about three quarters of an inch long, they leave this viscus, are carried along through the intestines, and, with the balls of fecal matter, fall to the ground, enter it, and transform themselves into pupæ, from which, after three or four weeks, they come out as perfect flies.

As each of these maggots, for its habitation, bores a cell as large as a grain of Indian corn, and by this operation causes more or less of irritation, often inflammation of the stomach; and as their number often amounts to many hundreds, we may imagine that the consequences would be very serious, as indeed they are, often causing fatal epidemic diseases of horses. In such cases the animal loses his appetite and flesh, is afflicted with cough, bites its sides, discharges much phlegm from the nose, breathes with great difficulty, and will die unless remedies are successfully used to expel these larvæ, such as mild laxative oils, etc.

But as the gad-fly that infests the horse is found only in fields, bots are found only in such horses as feed in pastures or work in the fields, and hence much may be done in the way of preventing their ravages by currying and cleaning the horse twice a day.

Dr. Harris, in his work on Injurious Insects, mentions also the Small Red-tailed Bot-fly (*Estrus hæmorrhoidalis*), which deposits her eggs on the lips, and the Brown Farrier

Bot-fly (*Estrus veterinus*), which deposits her eggs under the throat of the horse. The maggots then enter the mouth of this animal, are carried into the stomach, and go through the intestines like the former ones, producing the same effects.

The OX BOT-FLY (*Estrus bovis*) is nearly one inch long, has a yellow breast, with a black band across it, while the hind body is white and yellowish red, covered with hair, and resembling that of the bumble-bee. The female of this insect, with its long, horny ovipositor, pierces the skin of the ox or cow, generally on the back of the body, and deposits therein her egg, which is hatched by the caloric of the animal. The maggot, as soon as hatched, finds its nourishment in the cavity where it was born, and, as it develops, causes the skin to swell, forming a protuberance like that caused by gall-wasps on plants, and finally producing a running sore. In the month of May there may frequently be seen on the backs of young cattle from four to twenty such boils, each an inch thick, with an opening from which flows a purulent discharge. These maggots live about four weeks under the skin, when they come out from their disgusting and filthy abode, fall to the ground, change into pupæ, and a week after are transformed into the perfect fly. The female of this insect is so prolific that a single one may infest a whole drove of cattle with its eggs.

The SHEEP BOT-FLY (*Estrus ovis*) has transparent wings spotted at the lower margin, a brown spotted hind body, with yellow and brown lateral lines, sparingly covered with hairs. This insect does not show much inclination to fly or to walk, and is very slow in its motions. The female lays its eggs on the nostrils of sheep, whence the hatched maggots creep into the frontal cavity, and there develop until fully grown, when they come out, fall to the ground, and change into pupæ, in which state they remain about

six weeks before they are transformed into the perfect fly.

In former times, and even now, many country people think that these maggots are the cause of giddiness in sheep, and even epileptic fits, on which account the ancients recommended the maggots of the sheep bot-fly as a remedy for epilepsy; and we read in Trallianus that the oracle of Delphi advised a certain Democrates of Athens, who was afflicted with epilepsy, to use these worms tied up in a linen bag and worn around his neck.

This fact certainly argues that the Homeopathic Law taught by the celebrated Hahnemann, *Similia similibus curanter*, was applied to the treatment of disease in very ancient times, and those who will not acknowledge this law of therapeia must have very little acquaintance with the ancient history of medicine and its collateral sciences. Cicero, in his epistle to Atticus, says that the Greek physician Craterus cured the elephantiasis of the East, caused by immoderate use of reptile food, by administering small quantities of the flesh of vipers; and Antonius Musa, the physician of the Emperor Octavius Augustus, cured inveterate ulcers in the same manner.

Some years ago, when we were traveling through Hayti, there lived a Frenchman named Morin in the mountains of Fond des Negres, near Port-au-Prince, who was so fond of liquor that he filled a bottle with whisky out of a hog's-head in which we preserved snakes, lizards, toads, and frogs, and of course drank it all. Three weeks afterward his face and whole body were swollen, and covered with a thick, leathery skin, constituting the disease called elephantiasis. When that unfortunate man applied to us for a remedy for that dreadful disease, we, remembering the prescription of Craterus and Antonius Musa, advised him to use the flesh of snakes, which benefited him very much, and relieved his sufferings; but whether or no our homeo-

pathic remedy cured him we never heard, as we left the island soon after prescribing it, and have never heard from him since.

Formerly, when the negroes of St. Domingo were slaves, elephantiasis was more frequent among them than it is now, probably because they fed almost exclusively on the salted flesh of green turtles. So at one time, many years ago, about 40,000 people in the neighborhood of Cairo were afflicted with that disease, on account of the immoderate use of the flesh of different snakes, which they ate in order to please their prophet Mohammed, and to appear as saints among their fellow-men. But we do not intend to write a treatise on diseases, nor to advocate any particular dogma in medicine, and so must confine ourselves as closely as is possible to our main subject.

Among the flies with a fleshy proboscis there is none so blood-thirsty as the HORSE-FLY (*Tabanus*), and none have so terrible a sting. This instrument consists of six sharp needles, concealed under the proboscis, and so very sharp and strong is it that it pierces the thickest skin of horses, cows, and oxen, inflicting painful and bloody wounds. These flies are a real pest to horses and cattle, following them wherever they go, with loud humming, and, when once reaching them, fastening on to their skin and piercing it until often the blood oozes out in drops. Horses are sometimes so covered with them that their whole body is bloody, and the poor, tormented animals run away in their madness, breaking whatever vehicle is attached to them; so, also, whole herds have sometimes become furious from being stung by these insects, and have precipitated themselves into the first stream of water that they reach.

This genus horse-fly (*Tabanus*) must not be confounded with the BOT-FLY (*Estrus*), which also infests the horse,

because the latter deposits its eggs in the body of the horse, while the larvæ or maggots of the former, as well as their pupæ, are plentifully found in the ground, in meadows and near ditches.

Dr. Harris mentions three species of horse-fly, viz.: The BLACK HORSE-FLY (*Tabanus atratus*), the body of which is black, and its back covered with a whitish bloom, like a plum. This fly is almost an inch long, has very large wings, as well as very large, bluish-black, shining eyes, and is found commonly throughout the United States.

The BELTED HORSE-FLY (*Tabanus cinctus*) is smaller, of an orange color, and is not as common in the States.

The LINED HORSE-FLY (*Tabanus lineatus*) is still much smaller, and has a whitish line along the top of the hind body, and is very common.

There are many other species of this blood-thirsty genus, but most of them are smaller, and comparatively uninteresting; and as this order of insects has had the least attention from naturalists, there are very few facts known as yet regarding their life and history. We trust, however, that the zealous entomologist, Baron Osten Sacken, of the Russian Legation at Washington, will soon favor us with a volume on North American Diptera, which he has for several years made a principal study, and of which we are sadly in want.

The HOUSE-FLY (*Musca domestica*) is well known to every one as an insect about three lines long, which has a dark-brown thorax with four black lines, a dark-brown hind body spotted with black. The eyes are reddish-brown. Between the claws there is a small round ball, from which, when pressed, there issues a glutinous fluid, which enables the fly to run upon smooth surfaces, such as mirrors, windows, ceilings, etc., which hence become covered with dirty

spots. The wings are covered with millions of small hairs, which give them a glistening appearance, as the minute hairs can not be seen with the unassisted eye.

The house-fly is an inhabitant of every country on the globe; it is found in the coldest countries of Greenland, as well as the warmest portions of the torrid zone, and by mankind every where is esteemed a great nuisance. In its persevering impudence and provoking titillation it is no respecter of persons, attacking the king on his throne with as much freedom as the beggar in the ditch, and leaving every where the dirty remembrances of its offensive assaults. Still the poor fly can not be blamed, as it is only seeking its food, which consists in the juices of animals and the exhalations from their skin, as well as the moisture of plants and vegetables, and the decayed particles of food and offal.

These flies deposit their eggs in all kinds of manure, and hence are found in greatest abundance in the neighborhood of stables and farm-houses. Their maggots are also found on the corpses of animals, and wherever there is any filth, even in spittoons, if they are not constantly cleaned. They transform themselves into reddish-brown pupæ, from which the perfect flies are constantly issuing throughout the summer.

House-flies are often subject to a peculiar disease, the symptoms of which are, a considerable swelling of the hind body, which is filled with a greasy white substance, penetrating the skin, and accumulating on the surface of the body. In this condition we often find them dead upon windows or flowers, looking as if glued to them with their proboscis. The cause of this fatal disease is, probably, their intemperance in eating, or because they have partaken of some poisonous substance.

The house-fly is not only an inhabitant of every country, but it is found at all seasons of the year, although it is rarely seen in very cold weather except in warm rooms, or

where the sun shines brightly. The female is larger than the male ; and when about ready to lay her eggs, the hind body becomes so transparent that the eggs are seen through it on both sides. The development of the egg may best be observed by putting moistened wheat or barley into a glass vessel, and leaving it until it is spoiled and has become black, when three or four eggs will be seen on the grains and may be closely watched. These eggs are cylindrical in form, pointed at one end, and its surface shines like mother-of-pearl. After about twenty-four hours the maggot leaves the egg, and grows for two weeks, until it is about three lines long, when it is metamorphosed into a cylindrical red-brown pupa, from which the perfect fly, with its hairy gray feet, issues in about two weeks. These hairy feet are of great use to this little insect, and assist in keeping it nice and clean, because it uses them as brushes, with the hind ones to brush the dust from its wings, and with the fore feet wiping its face and eyes.

As these flies torment man, they are in the same ratio themselves tormented by very small mites, which in large numbers move between their hairs, and which they can not get rid of by any means. We resort to many measures to abate the nuisance of flies, and there are many mixtures recommended as sure death to these our little tormentors ; but it is doubtful, with all of them, whether they do not attract the flies in greater proportion than they destroy them. Dr. Harris says : " If a plateful of strong green tea, well sweetened, be placed in an outer apartment, accessible to flies, they will taste of it, and be killed thereby as soon as by the most approved fly-poison."

The MEAT-FLY (*Musca vomitoria*) is about half an inch long, and two lines thick, hairy, black, and has a shining blue hind body. This insect is remarkable for its extraordinary sense of smell, and hence a piece of meat can hardly be placed out of its reach ; for, unless very securely closed

against the attacks of all insects, these flies will scent it a great distance, and, arriving at it in crowds, they deposit upon it their eggs, which are commonly called fly-blows.

The maggots of this fly are well known in meat-shops, pantries, and kitchens, and are every where considered as disgusting in the extreme. They are spindle-formed, white, soft, and armed with two horny hooks, which enable them to move, and tear small pieces from the meat for their food. It is surprising how fast these maggots will develop. Signor Redi, a distinguished Italian naturalist, placed a fish at the disposal of these flies, upon which they soon deposited their eggs. The second day after these maggots were hatched they doubled in size, when thirty of them weighed one grain; but from that moment they grew so fast, that on the next, or third day, one maggot alone weighed seven grains, thus becoming two hundred times heavier in twenty-four hours. These maggots arrive at their full growth in about four days, when they creep to the ground, change into an egg-shaped pupa, and come out as perfect flies a few days after.

A great deal of instinct is exhibited by these flies in regard to the locality where they deposit their eggs, which must be a place that will furnish good food for their offspring: for instance, if you set before them a thin piece of meat, however good, they will move over it and feed upon it, but will not deposit an egg upon it, because they know it will soon dry up; but if you put a piece of meat upon a damp or moist ground, where it will decay rapidly, it will soon be covered with eggs, the maggots of which will scratch it with their hooks, and soil it with their fluid evacuations, causing the whole piece to putrefy very rapidly and become fetid.

The Meat-fly is a great lover of human cadavers, and in ancient times the people were much excited when it was ascertained that a human corpse was actually devoured by

worms; they looked upon it as a special instance of divine punishment; but as long as bodies were not buried deep in the ground, or were deposited in the vaults of churches, such things happened very frequently. These flies follow the coffins and hover about them, until, by the putrefaction and expansion of the bodies, the seams of the coffin are pressed open, when they enter the cracks, deposit their eggs, and soon after the maggots are hatched and ready for their depredations. Those, therefore, who wish to avoid being early devoured by worms must be interred, according to Masonic rule, in a grave six feet deep under ground, due east and west.

Another insect of this order, and perhaps the most distinguished in the archives of our Government, certainly the most celebrated in Congressional and editorial harangues, is The HESSIAN-FLY (*Cecidomyia destructor*).—This insect, although incorrectly, yet very generally, was believed to have been brought to America in 1780, in vessels laden with grain, by the Hessian army that was rented to Great Britain during the Revolutionary War. But, as we have said, this was incorrect, as this insect was seen and known in Staten Island, and at Flatbush, Long Island, as early as 1776. As early as 1788 the ravages of this insect had become so great throughout the fields of wheat, rye, and barley, in many of the States, as to cause very considerable alarm, and to call for decisive action on the part of the different Legislatures, as well as of Congress. Consultations were held as to the best means of averting an evil which threatened to be more terrible than pestilence. Messengers were dispatched to the different custom-houses in the United States, for the purpose of examining every ship-load that arrived, to see that no more of these insects were brought ashore; and notices to the same effect were sent to all our ambassadors in Europe. The debates in Congress, with the information that was collected in regard to this little insect,

occupied more than two hundred sheets of paper. At last Sir Joseph Banks, a distinguished naturalist in England, was applied to for information; but so little was known of entomology here that, although whole packages of descriptions were forwarded to him, he could not explain whether the injurious insect was a moth, a bug, or a fly.

Soon afterward, however, the natural history of the Hessian-fly, and the measures necessary to prevent its ravages, became the subject of investigation of several scientific gentlemen, among whom were Dr. Isaac Chapman, in the "Memoirs of the Philadelphia Society for the promotion of Agriculture;" Jonathan N. Havens, Esq., in the "Transactions of the Society for promoting Agriculture in New York;" Mr. Herrick, in the "American Journal of Science;" Mr. Edward Tilghman, of Maryland, in the "Cultivator;" and, above all, our distinguished naturalist, Thomas Say, in the "Journal of the Academy of Natural History of Philadelphia." From the researches of these distinguished men we derive the following information:

The Hessian-fly is very small, and its body and wings are entirely black. The female deposits her eggs on the stalk or leaves of wheat, barley, rye, and Timothy grass, as soon as the plants are up in the spring or fall, the maggots from which enter the stalk and feed upon its substance and sap, thereby weakening the stem and causing it to break and fall before the grain is ripe. The eggs are very diminutive, of a reddish color, and are hatched by the caloric of the atmosphere, according to the temperature, in one or two weeks. The maggots are also of a reddish color, and as soon as hatched fasten themselves on one of the joints and suck the sap of the stem, until after five or six weeks they attain their full size, and then change into light-brown pupæ from which the perfect insect soon emerges. This process takes place at least twice, and sometimes thrice a year, upon the wheat and other grain that grows in spring,

and upon that which grows in autumn, so that when there are two crops of grain a year there will be at least two generations of these flies.

Miss Margaretta H. Morris, of Germantown, Pennsylvania, whose labors in the science of entomology are well known, and whose articles, published in the "Transactions of the American Philosophical Society," have gained her great reputation, has discovered another species of Hessian-fly which lives altogether inside of the stalk, and which she calls *Cecidomyia culmicola*.

The means used to destroy these noxious insects have been very various, and not always as successful as anticipated. Miss Morris recommends obtaining seed-wheat from places where the fly has never been. Mr. Garret Bergen, of Brooklyn, New York, soaked his seed-wheat in strong pickle, and the crop was free from the fly. Mr. Herrick advises to burn the stubble of wheat, rye, and barley immediately after the harvest, and then plow and harrow the land, which process, he says, will destroy the largest part of the pupæ that are left.

Another very common insect of this order is the CHEESE-FLY (*Piophilæ casei*), which is not larger than a small ant, of a brown color, its neck shining like a mirror, and its wings larger than the body.

The maggots of this fly are better known than the perfect insect, and are almost universally found in cheese, although many persons are so little acquainted with the nature of these disgusting animals that they eagerly devour them—in fact, consider them as the most delicious portion of the cheese. It was formerly believed that these maggots originated by the putrefaction of the cheese; but the contrary is rather the case, for they crumble the cheese, admitting air into it, and soil it with their fluid excrement, which causes putrefaction, particularly when many of them die, as is often the case when the perfect insect has been stung

by small ichneumons. These maggots have a skin as strong almost as parchment, two horny hooks near the head, as in the meat-fly, with which they work the cheese and effect their jumping motions. In the performance of this latter feat these disgusting little creatures far excel man or any animal whatever. One of them not longer than a quarter of an inch will jump up into the air six inches—at least twenty-four times its length. How strange that we can look upon the wonderful feats like this, performed by insignificant little insects, without being amazed at the immense effort and agility displayed! It is only because we do not think of them sufficiently deep, and compare their motions with our own. The step of a fly is so small in comparison with that of a man, we do not think to compare the number or the speed of their steps to those of man, and yet the latter is the proper light by which to observe them.

M. Delisle once watched a fly, only as large as a grain of sand, which ran three inches in half a second, and in that space of time made the enormous number of five hundred and forty steps. If a man were to be able to walk as fast, in proportion to his size, supposing his step to measure two feet, he would, in the course of a minute, have run upward of twenty miles—a task far surpassing our express railroad engines, or even the famous “Seven League Boots” recorded in the nursery fable. So, in jumping or leaping, these insects display astonishing power. Some spiders leap a couple of feet upon their prey. The insect called the “frog-hopper” can leap more than two hundred and fifty times its own length. A flea can leap two hundred times its own length; so also can the locust. If a man were six feet long, and could leap as high and as far as one of these insects, he might stand near the custom-house in New York, leap up into the air over the top of Trinity Church spire, and alight in Greenwich Street; which would be

something more wonderful than has ever yet entered into the minds of the writers of fairy tales to conceive of.

The maggots of the cheese-fly, when fully grown, become very hard, leave the cheese, and fall to the ground, which they enter, and there remain for ten or twelve days, after which they emerge as perfect insects.

The Flea (Pulex irritans).

This insect, with its reddish-brown uniform, thick body, small head and antennæ, is probably as well known to persons of all classes of society and of all countries as any other insect in this order. It has no wings, and hence can not fly, but it has been placed among the flies of the order diptera, because its characteristics are more like those than any other, and it undergoes the same metamorphoses that all dipterous insects do, viz., depositing eggs, from which proceed maggots, which metamorphose into pupæ, and are afterward transformed into perfect insects.

The flea makes its abode principally in the fur of domestic animals, particularly the dog and cat, but it also dwells on foxes, mice, squirrels, bats, and pigeons, as well as upon the skin of man. As a general rule, its presence may be avoided by paying proper attention to cleanliness, by keeping the rooms of our houses dry and clean, and if pet dogs and cats are in the house, of keeping them also clean and free from these troublesome blood-suckers. If beds or carpets have become infested with them, dogs and cats will prove the best remedy, because these insects are attracted by them, and much prefer to dwell in their soft fur. Fleas are more numerous in the months of August and September, although no season is entirely exempt from them.

It was formerly, and is now, believed by many persons that all sorts of vermin are bred from filth, and that these insects originate from saw-dust under floors which have been often wet, on which account they are so often found in

nurseries. This, however, is a great mistake; for although they abound in filthy localities, it is only because the female has selected as a place of deposit for her eggs those places where they will be safe and furnished with a plentiful supply of food as soon as hatched; hence the damp cracks in floors are often chosen. The process of their development may be observed with ease and accuracy by putting some fleas with the black dust of decayed trees into a glass bottle, the opening of which is then covered with a magnifying glass. The female will soon be seen to deposit about twenty white, oval eggs, from which, after six days in summer, and twelve days in winter, small, white, snake-like maggots will proceed, which are scarcely one line long, but whose bodies are composed of thirteen hairy ringlets, and their heads provided with two short antennæ, a mouth, and two eyes. At the extremity of their hind bodies are seen two yellowish, fine bristles, which assist them in their serpentine motions. Most of the time they creep about, but if disturbed immediately conceal themselves. They must be fed with flies, of which the head is taken off, or with dried, pulverized blood. Under the solar microscope they appear ten feet long, and of course all their motions can be distinctly seen. In about two weeks they acquire their full growth, when they conceal themselves in the ground and metamorphose into a pupa, from which, about a week afterward, the perfect flea issues. The female flea drops her eggs any where she happens to be, but in preference upon heaps of manure, in the cracks of dirty floors, etc., on which account it is well to wash the floors with boiling water wherever they have appeared.

The head of the perfect flea is disproportionably small, and the eyes still much smaller, round, and shining. The antennæ are club-like in form, and the alimentary organ consists of a long, hollow sucking-sting, which probably represents the jaws. The whole body consists of twelve

ringlets and six feet, the extremities of which are provided with bristles and two claws, by which the flea produces a tickling sensation, when walking, upon the skin. Its hind pair of feet are much the longest, and endowed with extraordinary strength, in proportion to the size of the animal, which enables it to make as long journeys and in as quick time as if it had wings and could fly. We have already alluded to its wonderful feat of leaping a distance two hundred times longer than its body—a feat only realized by applying its magnitude to man or other larger animals. If a man five feet high was able to do the same thing, he could jump a thousand feet without trouble, and it would be a mere trifle for him to jump up over the cupola of St. Paul's Church in London, over St. Peter's in Rome, over the Münster in Strasburg, over the steeple of St. Stephen's in Vienna, or over any of the Pyramids of Egypt, which, averaging only a height of five hundred feet, would consequently require only half the bodily force.

The flea, however, is short-lived, and generally dies two or three days after having deposited her eggs. These insects are natives of Europe and Asia, where, in many localities, they are very troublesome, and from whence they have emigrated to North America. Our unpleasant and changeable climate, however, does not agree with them as well as their own native climate, and hence their number is quite small in comparison. A certain poet gives us the song of a young flea who had emigrated to this country from Prussia, and thus expresses his dissatisfaction to his sweet-heart in his abominable Berlin dialect:

“Kennst du nunmehr das Land, wo Dorngestripp und Disteln blüh'n,
Im frost'gen Wald nur eckelhafte Tannenzapfen glüh'n,
Der Schierling tief, und hoch der Sumach steht,
Ein rauher Wind vom schwarzen Himmel weht;
Kennst du es wohl? O lass uns eilig zieh'n,
Und schnell zurück in unsre Heimath flieh'n!”

A prose translation of which is: "Knowst thou now this country, where only briars and thistles bloom; where ugly fur-nuts only glow in the icy forest; where down in the vale the fetid hemlock grows, and on the hills the poisonous sumach; where heavy winds blow from black clouds over desolate lands? Dost thou not know enough of this country? Oh, then, let us fly in haste and return to our own fatherland!"

Another species of flea, and a much more troublesome and dangerous insect, is

The SAND-FLEA, or CHIQUE (*Pulex penetrans*), whose attacks have often been attended with horrible consequences, such as the loss of feet, legs, and arms, and even of human lives. This insect is very small, and can not hop like the former species, but runs about in the sand and dust in the mountainous parts of the West Indies, as well as in South America. Near the sea-shore and during the rainy season it is seldom seen; but as soon as the dry season begins, in the hilly localities, where coffee and cotton trees thrive, it is found in great abundance.

During our travels in San Domingo we were very anxious to make minute observations on those little creatures, which are very numerous upon all the high grounds during the dry season from August to March; but it must be confessed we were glad to leave the country as well and no wiser than before. We were confined to the bed for three months from the wounds caused by these insects, and were physically and mentally unable to make any observations, being under surgical care the whole time, and barely escaping amputation of the feet. Every part of the body almost was wounded by the stings of these horrible and stealthy enemies; and as soon as we recovered sufficiently to be able to move, we precipitately left their abode, and went from the coffee and cotton groves down to the sugar-cane fields near the sea-shore, in the neighborhood of Port-au-Prince.

Almost all we know, therefore, of the natural history of this formidable insect has been derived from the observations of others, our own unfortunate experience having taught us enough of the sufferings they are able to cause, and convincing us that if this sand-flea could leap like the common flea, the whole of tropical America would become uninhabitable.

The Sand-flea, or Chique, as we have already said, is very small; but the hind body of the female, just before she deposits her eggs, swells to an enormous size for the animal (we saw their bodies as large as a pea), and from it the head, neck, and feet seem to stick out as if protruded from a bag. The female almost imperceptibly, certainly without causing any noticeable sensation, works herself into the skin of the feet between the toe-nails and the flesh, as well as into the hands. By-and-by this produces a little itching, which we supposed at first to have been caused by a mosquito bite. If this happens to a person well acquainted with the insect and the country of which it is a native, it is sufficient to attract his attention to it, and he will at once have it extracted with a fine needle, which operation is performed by skillful negro women; but if he is unacquainted, and this operation be neglected, the hind body of the insect penetrates deeper and deeper into the flesh, and produces an excavation in it so deep that the abdomen, which resembles a bag, is entirely concealed, and only the small head is visible. When this bag, which contains an enormous number of eggs, attains the size of a large pea it bursts, and the almost invisibly small maggots creep out and scatter all over the neighboring parts, burrowing into the flesh, and every where forming new bags and excavations, by means of which not only painful, itching sores, but even malignant ulcers are generated.

The negro women of San Domingo are so accustomed to them, and so thoroughly trained, that they very skillfully

loosen such a bag from the flesh without tearing it; for, should it be torn, the young ones will imperceptibly disperse all over the foot or hand of the patient wherever they may have located, and every one of them will establish a new dwelling for itself.

As the negroes of that country all go barefooted, they suffer immensely from this plague, and are obliged to examine their feet and hands every day in order to extract this insect, if one has entered them; and, notwithstanding all this precaution, many of them become lame, and even lose their limbs by amputation. This was the case with a fool-hardy Capuchin monk, who, when he left San Domingo, took with him a live colony of these insects, which he allowed to dwell in his foot, in order to bring them in good condition to Paris, and present them for examination to the naturalists of the Academy of Sciences. The experiment proved unfortunate, both for him and for science; for his foot, covered with ulcers, and loaded with these insects, had to be amputated to save his life during the voyage, and was given up to the waves of the ocean.

This insect is also found in Brazil, where it is called *Tunga*; also *Bicho*. The inhabitants of the Antilles, to prevent its entering their flesh, use the caustic oil of the Cachew-nut (*Anacardium occidentale*); they also use tar to besmear the feet with; but there is no remedy, after the sand-flea has entered the flesh, but to extract it without rupturing its bag, or abdomen.

The Mosquito (Culex).

This insect, called by the French *Maringouin*, or *Cousin*, and by the Germans *Stechschnacke*, or *Gölse*, is a genus of the order Diptera, so numerous that its species cover the globe from one pole to the other, and from east to west through both hemispheres; and as most of them exhibit the same mischievous propensities and general characteris-

tics, differing here and there mainly in size, it is very difficult to divide them into many different and distinct species. Nor do we propose to attempt it here; but so common an insect we could not omit, even in our brief history of North American diptera. We trust, however, to see a work on this subject ere long from Baron Osten Sacken, in which all the flies of our country will be properly and scientifically classed.

There are few insects of which man and beast complain so much as of the mosquitoes. It is true that there are insects, such as wasps, bees, and the fleas we have just mentioned, that inflict painful and even dangerous wounds, but no other insect pursues us with such obstinacy, day and night, and is such a universal torment to man, as the mosquito. In some localities, particularly near rivers, lakes, and ponds, the inhabitants can scarcely invent means to protect them from the attacks of these insects; nor are our cities exempt from them, but almost every where they are found biting and sucking our blood during the day, and at night whistling and singing in our ears, preventing all sleep to those that are not covered with gauze.

When traveling some years ago in the country of the Czernomorzi, or Cossacks of the Black Sea, we observed before each house of the different *stanitzas*, or villages, of the Cossacks, large heaps of half-dried manure ignited and smoking, which our driver informed us was for the purpose of keeping off the mosquitoes. Toward evening, on a very hot June day, we ascended the right bank of the muddy and slowly-running River Kuban, on the left bank of which the independent Circassia stretched out before us, when suddenly swarms of small mosquitoes covered us, our servant, and driver, and horses, lighting upon us in lumps an inch thick, and, in spite of all the covering we could hastily throw over us, tormenting us excessively with their bites.

On the road, at a distance of every four or five versts (three or four English miles), we found a military post of about a dozen Cossacks, keeping themselves and their horses under ground, except one sentinel, who was standing upon a scaffold twelve feet high, in order to watch any inimical movements of the Circassians, to repulse their attacks, and, in case of one, to give notice of it to the two nearest posts by means of the ancient Persian telegraph, viz.: by igniting a bundle of straw, which was then fastened to the top of a high pole and elevated. At midnight our misery reached its climax. Though covered with a wide cloak, the mosquitoes entered every opening, and inflicted upon us such painful wounds that our faces were so swollen we could scarcely recognize one another. To our joy a large camp-fire was seen at some distance, which, according to the driver's assurance, was the post-station, where fresh horses could be had. We arrived at the spot, and with great precipitation left the carriage, running in haste to the fire, near which a large dog was howling and running as if mad; the horses, as soon as they were unharnessed, sprang into the fire to get rid of the mosquitoes, and only with difficulty could they be removed to the subterranean stable, where the postmaster, a half-invalid officer of the army, with some men and a number of imperial horses, resided. The officer immediately ordered fresh horses for us, and, looking from under a very heavy covering at our pitiful condition, told us to hurry on, and by daybreak we should arrive at the next station, where we could find comfortable houses and be relieved from the attacks of mosquitoes. In less than five minutes the horses were harnessed, and the Russian word *Boshool*, "Go on," from the commander to the new driver, was music to our ears. When we arrived at the next station we stopped at the first house, the owner of which was a captain of the Cossacks, who received us with the usual hospitality, inborn in the Russians of all grades,

and entirely unknown in any part of Europe or America, Poland and Hungary excepted. The captain conducted us into a well-furnished, comfortable room, assisted us to undress and get to bed, and from time to time applied wet cloths to our swollen face and body, until a profound sleep temporarily relieved our excruciating pains. The same care was taken of our servant, who, in the madness caused by his sufferings, attempted to shoot himself that he might be out of misery, but was prevented by two athletic Cossacks, and watched and nursed until he, too, was relieved by sleep. It was not until after a week of suffering that the fever and inflammation subsided so that we could open our eyes, and then, with many hearty thanks to our hospitable host, Captain Wasil Iwanovich, and his kind-hearted family, and with the deepest gratitude, we continued our travel to Mosdok, from which town we went with a caravan, escorted by two cannon, two hundred infantry, and sixty Cossacks on horseback, through the fertile valleys of romantic Circassia, with her castles and warlike knights, to the Russian fortress Wladicaucas; thence we ascended the bank of the furious Terek, through the Porta Caucasica, to the height of nine thousand feet, from which we descended to the delicious plains of Transcaucasia, every where enjoying the same hospitable reception.

The utmost hospitality is found among all the Russians, and one can not visit their principal cities without being thoroughly convinced of it. The English Captain Cochrane, known by his pedestrian travels in Russia, started from St. Petersburg, taking with him only five francs, and when he arrived in Moscow—a distance of seven hundred versts, or four hundred English miles—his five francs were still in his pocket.

As the Cossacks of the Black Sea are no agriculturists, but derive their subsistence from their numerous herds of horses, oxen, sheep, goats, and hogs, they suffer immensely

at times from the ravages of the mosquitoes. Although they are fortunately not seen every year, these blood-suckers may be considered a real Egyptian plague among the herds of these Cossacks; for they soon transform the most delightful plains into a mournful, solitary desert, killing all the beasts, and completely stripping the fields of every animated creature. One can not look upon the spectacle without pity when he sees the poor cattle exhibiting so much terror at the approach of these innumerable swarms of mosquitoes, whole herds hurrying home for shelter, running as if mad, and often, in their fright, plunging into the river and being drowned. Thousands of these insatiate tormentors enter the nostrils, ears, eyes, and mouth of the cattle, who shortly after die in convulsions, or from secondary inflammation, or from absolute suffocation. In the small town of Elizabethpol alone, during the month of June, thirty horses, forty foals, seventy oxen, ninety calves, a hundred and fifty hogs, and four hundred sheep, were killed by these flies.

In temperate climates this kind of mosquito is only terrific during several weeks in summer, but in the tropics, although they are not so injurious, they are very troublesome throughout the year; and in our excursions in the Antilles of America we could never enter the woods without having the head, face, and neck covered with gauze, and the hands with leather gloves, for every leaf of every plant and tree actually swarmed with them.

As we have already mentioned, there are many species of the mosquito scattered all over the globe, but their external and internal condition and characteristics, as well as their habits and manner of living, are about the same. They are provided with a long, horny, stiff, and perpendicular proboscis, with antennæ consisting of fourteen joints, feathered on the males, and with two wings covered with small scales. Every part of this insect, when magnified, presents not only a beautiful and wonderful appearance, but

can not fail of exciting contemplations of the most serious kind. Indeed, one has no idea of the amazing beauty of these diminutive creatures until he has observed them through a microscope.

The common Mosquito (*Culex pipiens*) of America, as well as of Europe, is gray, and has immaculate wings. The females are the principal tormentors, hovering up and down in large swarms near the water, and at night persecuting man and beast with their stings, as well as their intolerable music.

Their visible proboscis is not the sting itself, but only the case or scabbard which incloses the instruments for piercing the skin and sucking our blood. These instruments are five bristles, which may be seen protruding from the scabbard, or proboscis, if you take hold of the neck of the insect and squeeze the proboscis. These bristles, cut off and placed under the microscope, appear like lancets with a hook in the end, which remains in the wound made by it, if the insect be driven away suddenly when sucking, and which causes greater pain and inflammation than if the insect is allowed to withdraw it when he has ceased sucking. After the hollow sting has entered the flesh about three-quarters of a line, and the insect has filled its body with human blood, the wound begins to itch and swell—not on account of the insignificant puncture, but on account of the venomous saliva which entered it, for the purpose, probably, of diluting the blood. We see the same thing when a fly drops some liquid from its proboscis upon a piece of sugar, in order to dissolve it and diminish its strength, so that it can suck it up. The saliva, therefore, performs the same office in insects that it does in mammals when masticating their food.

Mosquitoes deposit their eggs in stagnant water, and this is probably the reason that they are more numerous in wet summers. If a hogshead or barrel of water be placed

in the garden or yard during the summer, it will in a few weeks be entirely populated with the larvæ of mosquitoes; for each female deposits about three hundred eggs, which, in three or four weeks after, are metamorphosed into perfect flies, which again deposit new eggs, and so on until six or seven generations take place in one season. Their immense number would give us much trouble in every section of the country were they not the favorite food of many birds, particularly of the swallows, as well as of dragon-flies and other insects, who diminish their number and help to rid us of their troublesome company.

Their eggs are of an oval form, and, perpendicularly glued together in masses, swim upon the water like rafts, about three lines long. They are at first white, but become green after a few hours, and afterward gray. After two days the larvæ come out, and swim around with the greatest rapidity, very often coming to the surface of the water to breathe, their respiratory organ being situated at the extremity of the hind body. In two weeks they change into a pupa, which still remains upon the surface of the water, and after a week bursts open, and the perfect mosquito flies out as if shot from underneath the water.

THE END.



$$F = \frac{F}{F_{\text{ref}}}$$

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